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COMMITTEE ON THE PEACEFUL
USES OF OUTER SPACE

COORDINATION OF OUTER SPACE ACTIVITIES WITHIN THE UNITED NATIONS SYSTEM: PROGRAMME OF WORK FOR 1998 AND 1999 AND FUTURE YEARS

Report of the Secretary-General

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EXPLANATORY NOTES

Secretariat units, bodies and specialized agencies

UNEP	United Nations Environment Programme
ECE	Economic Commission for Europe
ESCAP	Economic and Social Commission for Asia and the Pacific
ECLAC	Economic Commission for Latin America and the Caribbean
ECA	Economic Commission for Africa
ESCWA	Economic and Social Commission for Western Asia
UNDCP	United Nations International Drug Control Programme
UNDP	United Nations Development Programme
UNITAR	United Nations Institute for Training and Research
FAO	Food and Agriculture Organization of the United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
ICAO	International Civil Aviation Organization
WHO	World Health Organization
ITU	International Telecommunication Union
WMO	World Meteorological Organization
IMO	International Maritime Organization
UNIDO	United Nations Industrial Development Organization
IAEA	International Atomic Energy Agency

Other acronyms and abbreviations

ADEOS	Advanced Earth Observing Satellite
ADS	automatic dependent surveillance
AFRICOVER	Digital Land Cover Database for Africa
AGRHYMET Centre	Agrometeorology and Operational Hydrology and Their Applications Centre
AISI	African Information Society Initiative
AOCRS	African Organization for Cartography and Remote Sensing
ARTEMIS	Africa Real-Time Environmental Monitoring Information System (FAO)
AVHRR	advanced very high resolution radiometer
BDT	Telecommunications Development Bureau (ITU)
BR	Radiocommunication Bureau (ITU)
CCD	Convention to Combat Desertification
CEOS	Committee on Earth Observation Satellites
CIAT	Centro Internacional para la Agricultura Tropical
CLIPS	Climate Information and Prediction Services (WMO)
CNS/ATM	communications, navigation and surveillance and air traffic management
COPINE	cooperative information network linking scientists, educators, professionals and decision makers in Africa
COSPAS-SARSAT	International Search and Rescue Satellite System
CPM	Conference Preparatory Meeting (ITU)
DCP	data collection platform
DEIA	Division of Environmental Information and Assessment (UNEP)
DIS	Desertification Information Systems
DSS	decision support system
EAP-AP	Environment Assessment Programme—Asia and the Pacific

EIN	Environmental Information Networking
EIS	Environmental Information Services (UNEP)
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EMPRES	Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (FAO)
EUTELSAT	European Telecommunications Satellite Organization
ENRIN	Environmental and Natural Resource Information Networks (UNEP)
EOS	Earth observing system
EPA	Environmental Protection Agency (United States of America)
EPIRB	emergency position-indicating radiobeacon
EROS	Earth Resources Observation Satellite (United States of America)
ERS	European remote sensing satellite
ESA	European Space Agency
FAME	Forest Assessment and Monitoring Environment (Netherlands/FAO)
FRA	Forest Resources Assessment (FAO)
GARS	Geological Applications of Remote Sensing
GAW	Global Atmosphere Watch (WMO)
GCOS	Global Climate Observing System (ICSU/IOC/UNEP/WMO)
GEF	Global Environment Facility
GIEWS	Global Information and Early Warning System (FAO)
GIS	Geographic Information System
GLONASS	Global Orbiting Navigation Satellite System (Russian Federation)
GMDSS	Global Maritime Distress and Safety System
GMPCS	global mobile personal communications by satellite
GNSS	Global Navigation Satellite System
GOSSP	Global Observing Systems Space Panel
GOOS	Global Ocean Observing System (ICSU/IOC/UNEP/WMO)
GPS	Global Positioning System
GRID	Global Resource Information Database (UNEP)
GT-Net	Global Terrestrial Observing Network
GTOS	Global Terrestrial Observing System (FAO/ICSU/UNEP/UNESCO/WMO)
HYCOS	Hydrological Cycle Observing System (WMO)
ICAMS	Integrated Coastal Analysis and Monitoring System (EOS/FAO)
ICIMOD	International Centre for Integrated Mountain Development
ICSU	International Council of Scientific Unions
IDNDR	International Decade for Natural Disaster Reduction
IGAD	Intergovernmental Authority on Development
IMT-2000	International Mobile Telecommunication 2000
INFOCLIMA	World Climate Data Information Referral System
INFOTERRA	International Environmental Information Exchange and Referral System (UNEP)
Inmarsat	International Mobile Satellite Organization
INTELSAT	International Telecommunications Satellite Organization
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IRG	inter-conference representative group (ITU)
ITC	International Institute for Aerospace Survey and Earth Sciences
ITU-R	ITU Radiocommunication Sector
LIS	land information system
MAB	Man and the Biosphere (UNESCO)
MAP	Mediterranean Action Plan
MRAC	Royal Museum of Central Africa (Belgium)
NASA	National Aeronautics and Space Administration (United States of America)

NASDA	National Space Development Agency (Japan)
NESDIS	National Environmental Satellite, Data and Information Service (NOAA)
NOAA	National Oceanic and Atmospheric Administration (United States of America)
OSS	Observatoire du Sahara et du Sahel
PANGIS	Pan-African Network for a Geological Information System
PHARE	Poland/Hungary Aid for the Reconstruction of the Economy
ProMIS	Programme Management Information System (FAO/UNDP)
RAMSES	Reconnaissance and Management System of the Environment of Schistocerca (FAO)
RAPIDE	African Network for Integration and Development
LANDSAT	Land Remote Sensing Satellite
RECTAS	Regional Centre for Training in Aerospace Surveys
RCSSMRS	Regional Centre for Services in Surveying, Mapping and Remote Sensing (ECA)
REIMP	Regional Environmental Information Management Project for Central Africa (EU/FAO/GEF/World Bank and bilateral donors)
RMTC	Regional Meteorological Training Centre (WMO)
SADC	Southern African Development Community
SARPs	Standards and Recommended Practices (ICAO)
SISEI	Information Systems to Monitor the Environment through the Internet (UNITAR)
SOE	state of the environment
SOLAS	International Convention for the Safety of Life at Sea
SOTER	Soils and Terrain Digital Database (FAO/International Soil Reference and Information Center/International Society of Soil Sciences/UNEP)
SPACECOM	Space Communications Technology Applications (ITU)
TCDC	technical cooperation among developing countries
TELECOM	World Telecommunication Exhibition and Forum (ITU)
USAID	United States Agency for International Development
USFS	United States Forest Service
USGS	United States Geological Survey
WAFS	World Area Forecast System
WCMC	World Conservation Monitoring Centre
WCRP	World Climate Research Programme (ICSU/IOC/WMO)
WRC	World Radiocommunication Conference (ITU)
WTDC	World Telecommunication Development Conference
SPOT	Système pour l'observation de la Terre

INTRODUCTION

1. The present report has been prepared by the Secretary-General at the request of the Committee on the Peaceful Uses of Outer Space and concerns efforts at coordinating the activities of organizations within the United Nations system that relate to assistance to developing countries in the practical applications of space technology.

2. The report is based on the contributions submitted by the organizations concerned in response to the United Nations request for information on concrete programmes of work envisaged primarily for 1998 and 1999 and was finalized at the Inter-Agency Meeting on Outer Space Activities, held at Vienna from 2 to 3 June 1998.

3. The report consists of three sections. Section I contains a list of the participants in outer space activities within the United Nations system; a matrix of outer space programmes is also provided to identify the activities of each participant in specific fields. Section II presents a summary of major activities and programmes planned for 1998 and 1999 and future years by the organizations within the United Nations system as a whole. Section III presents concrete activities or programmes planned by individual organizations in an integrated form under subsections on remote sensing and the geographic information systems (GIS), communications and navigation, meteorology and hydrology, basic space science, safety aspects and natural disaster reduction, as well as other activities in the field of space science and technology and its applications.

4. There are three headings—education and training programmes, expert services and survey missions, and dissemination or exchange of information—under each of the first three subsections in section III (remote sensing and GIS, communications and navigation, and meteorology and hydrology). Concerning the last of those headings, organizations within the United Nations system continued to develop and improve databases to disseminate information with increased accuracy, quantity and speed. In the present report, activities related to the establishment or development of databases are categorized as studies on or implementation of pilot projects, while those related to the operation of databases, after the development phase is completed, are categorized as dissemination or exchange of information.

5. Valuable information on space technology or on operational systems can also be disseminated at meetings or conferences where decision makers in space activities exchange opinions and may elaborate strategies or plans for future activities. Since the main purpose of such meetings or conferences is not to educate or train, they are also categorized as dissemination or exchange of information, rather than education and training programmes.

6. Under the subsection on remote sensing and GIS, there is one more heading, "Capacity-building", reflecting the increase in efforts to develop indigenous capability in space science and technology in developing countries.

7. Under the subsection on activities in the field of communications and navigation, there are two additional headings relating to the efforts in the United Nations system concerning legal aspects. One concerns the regulation of the use of the geostationary satellite orbit and the radio-frequency spectrum allocated to space communication services. The other heading concerns the efforts towards the establishment of new legal frameworks or the development of new technological systems to complement the existing legal frameworks.

I. PARTICIPANTS IN OUTER SPACE ACTIVITIES WITHIN THE UNITED NATIONS SYSTEM AND MATRIX OF OUTER SPACE PROGRAMMES

8. The participants in outer space activities within the United Nations system included the following Secretariat units, bodies, research institutes, specialized agencies and other organizations: Office for Outer Space Affairs, International Decade for Natural Disaster Reduction (IDNDR) secretariat, Economic Commission for Europe (ECE), Economic and Social Commission for Asia and the Pacific (ESCAP), Economic Commission for Latin America and the Caribbean (ECLAC), Economic Commission for Africa (ECA), Economic and Social Commission for Western Asia (ESCWA), United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP), Food and Agriculture Organization of the United Nations (FAO), United Nations Educational, Scientific and Cultural Organization (UNESCO), International Civil Aviation Organization (ICAO), World Health Organization (WHO), World Bank, International Telecommunication Union (ITU), World Meteorological Organization (WMO), International Maritime Organization (IMO), World Intellectual Property Organization (WIPO), United Nations Industrial Development Organization (UNIDO), International Atomic Energy Agency (IAEA) and United Nations Institute for Training and Research (UNITAR).

9. A matrix of outer space programmes within the United Nations system is presented below.

II. SUMMARY OF MAJOR ACTIVITIES AND PROGRAMMES PLANNED FOR 1998 AND 1999 AND FUTURE YEARS

10. Organizations within the United Nations system have planned activities for 1998 and 1999 and future years within the fields of remote sensing and GIS, communications and navigation, meteorology and hydrology. Valuable space-related or space-aided activities in basic space sciences, improvement of safety and natural disaster reduction, as well as other activities related to space science and technology and its applications will also be conducted by organizations within the United Nations system.

11. The planned activities range from education and training to operational applications of technologies. Three categories of activities are notable in most of the above-mentioned fields of space activities. The first category to be noted is the education and training programmes, which are generally offered by holding training courses, workshops and seminars or supporting fellowships. Efforts are being made to improve the educational and training environment by providing educational tools.

12. Secondly, organizations within the United Nations system provide expert services and conduct survey missions to identify specific areas of applications relevant to a given country or group of countries. Specific studies on pilot projects in a country or group of countries are also being conducted. In recent years, there has been increasing emphasis on maximizing the benefits from space activities for social and economic development through operational applications of existing space technologies. A number of projects with such emphasis are carried out at the local, regional or global level.

13. Thirdly, dissemination of information on the status of technology or on the operational systems has always been an important element in space activities. Organizations within the United Nations system issue numerous recurrent or non-recurrent publications on emerging new space technologies. The publications also contain suggestions on possible applications of those technologies. More information is being distributed through computer networks, which in turn stimulates demand for the further development of databases. The use of the Internet and its various services, including electronic mail, File Transfer Protocol, name lists and the World Wide Web, is considered a very appropriate means of improving coordination among the organizations of the United Nations system, and efforts are being made to further expand the use of the Internet for such purposes.

Participants in outer space activities and matrix of outer space programmes[a]

United Nations entity	*Remote sensing*	*Communications and navigation*	*Meteorology and hydrology*	*Basic space science*	*Safety aspects and natural disaster reduction*	*Other activities*
OOSA[b]	29,38,39,44,61-63, 137,143	167,174,176,180		250-252	254,255	272,273,276, 278-281,291
IDNDR secretariat[c]					256,257,261	
UNDCP	63,107					
UNEP	61,64-81,105,114, 127-130,135,144-157	181-183	220,221,224,231,236, 237,240,246,247,248			282
ECA	30,31,44,45,82-86, 131,138,139	168,177,178,184, 195				274
ECE	154					
ECLAC						275
ESCAP	32,39,46,61,87,132, 133,140,151,158,159	169,185-187,196, 198	215,225,241,249	253		277,283-285
ESCWA	88-90					286
UNDP	74,78,120,151,161(d)		219,227			
UNITAR	123-126,136,137,155, 166					
FAO	33,40,41,47-59,61,76, 82,86,91-114,135, 150,160-163		222-224,237,244,248			287
UNESCO	34-37,42,60,61,83,92, 105,114-122,134,141, 142,164,165	188-197,205,206	216,218,224,226,228, 229,236-239,242,244, 247,248		258	
UNIDO	143					288, 289
ICAO		170,207,208, 211-214	239			
WHO	154					
ITU		171-173,175,179, 190-194,197, 199-204,206,209			259-262,264	
WMO	61,105,114,135		217,219,226,227-239, 243-248		264	
IMO		210,211,214			259,262-264	
WIPO						290
World Bank	59,109,149		227(a)			
IAEA					265,266	

[a] The numbers in each column indicate the relevant paragraphs in the present report.
[b] Office for Outer Space Affairs of the Secretariat.
[c] International Decade for Natural Disaster Reduction secretariat.

14. In the field of remote sensing, the United Nations and its specialized agencies have planned a number of international, regional and national training courses and workshops. They cover remote sensing applications in general as well as specialized topics such as sustainable development of natural resources and energy, natural resources and environment management, land-cover mapping and land-use planning. Most of these international and regional training courses are jointly organized by two or more organizations within the United Nations system, often in cooperation with other international organizations and/or Governments.

15. Many of the organizations of the United Nations system offer expert services in their respective areas of competence and carry out pilot projects with the use of remote sensing technologies and GIS. These technologies are applied to a wide range of activities, such as environment monitoring and management, management of natural resources and natural disasters, early warning for food security, land-cover mapping and land management, forest planning and management, mapping of desertification, monitoring of cultural sites and pest disease control. A number of projects by the organizations of the United Nations system are aimed at establishing databases or information networks at the regional or global level, such as the Digital Land Cover Database for Africa (AFRICOVER), the Regional Environmental Information Management Project (REIMP) for Central Africa, the Africa Real-Time Environmental Monitoring Information System (ARTEMIS), Geological Applications of Remote Sensing (GARS) programme, Global Resource Information Database (GRID) and the Integrated Coastal Analysis and Monitoring System (ICAMS), to name a few.

16. In the area of dissemination of information, organizations either provide information upon request or issue recurrent or non-recurrent publications concerning technological status or existing operational systems to increase awareness of the useful applications of remote sensing technologies. Reflecting the rapid expansion of the information superhighway with the use of computer networks, an increasing number of organizations are establishing databases that will tremendously increase the availability of data of interest for a larger number of users. It should be noted that meetings of experts or decision makers and workshops organized within the United Nations system also provide opportunities to exchange updated technological or policy-related information that is vital in elaborating regional or global strategies for social and economic development with the use of remote sensing technologies.

17. There will be a number of activities within the United Nations system with the particular objective of capacity-building in developing countries in the use of remote sensing and GIS technologies. Most of the efforts will be directed towards the strengthening of operational capability of existing regional or national institutions involved in environmental management for sustainable development, food security, natural resource monitoring or land-cover mapping. Especially within the framework of field projects, the development of human resources is considered an important factor.

18. In the field of communications and navigation, the United Nations system will organize a training course and several workshops and seminars and provide fellowship support for in-depth training. As far as expert and technical advisory services are concerned, organizations within the United Nations system participate in the development of domestic or regional satellite communication systems for various purposes such as improving distance education, increasing public awareness in environmental protection and supplementing early warning systems for natural disaster reduction and food security. Satellite communication systems are also considered a vital tool for social and economic development, particularly for rural and remote areas in developing countries. Some projects, such as Space Communications Technology Applications (SPACECOM) in all developing countries, aim at promoting the broad applications of space communications technology in developing countries. Satellite communication systems are also used to improve communications between the headquarters and the regional offices of the organizations or among their regional offices, as demonstrated by the Mercure satellite telecommunications system.

19. The results or interim reports of the projects or studies on the use of satellite technology conducted within the United Nations system are also available in the form of recurrent or non-recurrent publications or disseminated in electronic form through computer networks.

20. In view of the rapid increase in the use of frequency bands for various services, efforts are being made to update the international radio regulatory process and to prepare for future requirements. The review of the spectrum/orbit resources allocation procedure is also under way with a view to increasing efficiency and equity in spectrum/orbit utilization.

21. The work of the specialized agencies of the United Nations is also making significant contributions in the area of applications of space technology for land, maritime and aeronautical mobile communications. Studies on a worldwide radio-navigation system are being conducted within the United Nations system. As the operational availability of the Global Positioning System (GPS) and the Global Orbiting Navigation Satellite System (GLONASS) is limited, consideration is being given to a post-GPS/GLONASS system. In order to meet future civil aviation requirements into the next century, efforts are being made to improve air navigation systems, including space elements.

22. The application of satellite technology constitutes an important element of technical cooperation activities in operational meteorology and hydrology. Several training programmes are planned for 1998 and 1999 to discuss various subjects such as satellite meteorology, tropical meteorology and marine studies.

23. Through the provision of expert services, efforts are made to develop a marine and coastal zone data information system, to improve management of water and coastal resources, to upgrade meteorological observations by installing networks of data collection platforms (DCPs) and to improve the meteorological telecommunication system by planning the implementation of a regional meteorological telecommunication network in various regions. Reflecting the increasing awareness of global changes, including climate change as well as their impact on global, regional and national economies, organizations within the United Nations system also cooperate in global schemes, such as the Global Climate Observing System (GCOS), Global Terrestrial Observing System (GTOS), Global Ocean Observing System (GOOS), World Weather Watch, World Area Forecast System (WAFS), Global Atmosphere Watch (GAW), World Climate Research Programme (WCRP) and World Climate Data and Monitoring Programme. A series of technical reports on climate research and ocean observations, as well as water-resource management, is also published.

24. In basic space sciences, efforts continue to be made to support space research activities of scientists from developing countries by sponsoring their participation in international meetings relating to space science.

25. Organizations within the United Nations system also make efforts towards the improvement of safety in various human activities. While studies are under way to apply space technology to establish safety and early warning systems, such as the Global Maritime Distress and Safety System (GMDSS) and early warning systems for the reduction of natural disasters. Space-based technology represents an integral component in the development of a disaster reduction system for the twenty-first century. As expressed in the report of the Secretary-General entitled "Improved effectiveness of early-warning systems with regard to natural and similar disasters" (A/52/561), facilitating access to Earth observation data is of paramount importance in order to develop a comprehensive disaster prevention strategy, in particular at the community level and in most disaster-prone areas, where the impact of natural disasters on economic and social stability as well as on developmental efforts are the most severe, and where the benefits of effective prevention pay most. Consideration is given also to emerging risk and danger as a result of expanding space activities, such as the risk of the use of nuclear power sources in outer space. Space technology can be a solution for safety in many aspects. Conversely, space activities may create a risk which should be dealt with by various organizations.

26. Further progress has been achieved towards the establishment of United Nations-affiliated regional centres for space science and technology education in cooperation with the Secretariat, regional commissions and other interested organizations within the United Nations system. Following the Centre for Space Science and Technology Education in Asia and the Pacific, centres in Latin America and the Caribbean and in Africa will be established by the end of 1998.

27. The time has come for the United Nations system to identify common objectives to be pursued and develop strategies in promoting sustainable development on a global scale into the next millennium. While the United Nations system, with various organizations with specialized knowledge and expertise and with influence on the international community, has high potential to contribute to global prosperity, maximum efforts should be made for the optimum use of available resources by coordinating the activities of those organizations. Such efforts for the enhancement of coordination should not be seen as an attempt to intensify a zero-sum competition among the organizations in the distribution of resources. The rewards of coordination within the United Nations system may be best achieved if the organizations identify the unique role of each organization and strengthen their cooperation in achieving the common goals to be pursued by the system as a whole.

28. The importance and potential of space science and technology for the prosperity of Earth and human beings are widely, although not sufficiently, recognized. While the organizations within the United Nations system engaged in space activities are making the benefits from space applications available to the international community within their respective mandates, further coordination of space activities among the organizations is emphasized by Member States. As the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), to be held in July 1999, prepares a global action plan for the peaceful exploration and exploitation of outer space into the twenty-first century, organizations within the United Nations system should contribute actively to the work of UNISPACE III. At this crucial juncture in the preparations for UNISPACE III, organizations within the United Nations system have the responsibility to suggest concrete actions to strengthen their role in advancing the socio-economic condition of the global community through the effective use of space science, technology and their applications for the benefit of all countries.

III. ACTIVITIES PLANNED BY ORGANIZATIONS WITHIN THE UNITED NATIONS SYSTEM FOR 1998 AND 1999 AND FUTURE YEARS

A. Remote sensing and the Geographic Information System

1. Education and training programmes

Training courses, workshops and seminars

29. The United Nations Programme on Space Applications is planning the following training courses in the period 1998-1999:

(a) Eighth United Nations International Training Course on Remote Sensing Education for Educators, organized in cooperation with the Government of Sweden, to be held at Stockholm and Kiruna, Sweden, from 4 May to 12 June 1998;

(b) Ninth United Nations International Training Course on Remote Sensing Education for Educators, to be held at Stockholm in 1999;

(c) United Nations/China Workshop on Applications of Space Technology in Sustainable Agricultural Development, to be held in 1999.

30. During 1998 and 1999, the Regional Centre for Services in Surveying, Mapping and Remote Sensing (RCSSMRS) of ECA will organize short-term courses on:

(a) Application of remote sensing and GIS for geological and mineral assessment and mapping, in March 1998;

(b) Land use, land degradation assessment and monitoring the use of remote sensing techniques, in June 1998;

(c) Application of remote sensing and GIS for early warning systems for food security, in September 1998;

(d) Use of remote sensing in the assessment of land degradation, drought and desertification monitoring, in March 1998;

(e) Use of remote sensing data for assessment of geologic and environmental resources, in June 1999;

(f) GIS for natural resources assessment, monitoring and management, in September 1999.

31. The Regional Centre for Training in Aerospace Surveys (RECTAS) of ECA will continue to provide regular long-term courses on remote sensing and GIS for technicians and technologists with a duration of 18 months and for postgraduates with a duration of 12 months. Substantive servicing of customized short courses, seminars and workshops on remote sensing applications will also be provided as necessary.

32. ESCAP, in cooperation with the National Space Development Agency (NASDA) of Japan, will hold the Seventh Regional Tropical Ecosystem Seminar on Earth Observation for Tropical Ecosystem Management at Dhaka, Bangladesh, from 7 to 11 December 1998.

33. FAO plans to organize, jointly or on its own, the following remote sensing training courses, workshops and seminars in 1998:

(a) FAO/German Foundation for International Development regional training courses on the application of remote sensing and GIS for sustainable forest management for Latin American and south-east Asian countries in 1998;

(b) FAO technical workshops on land-cover mapping, to be held within the framework of the AFRICOVER project in 1998.

34. UNESCO will support the following postgraduate training courses in 1998, in 1999 and beyond:

(a) Postgraduate course on integrated study and rational use of natural resources at the University of Paris, the University of Montpellier and the University of Toulouse, France;

(b) International postgraduate training course on the applications of remote sensing, digital image processing and aerospace surveys for applied geomorphology and engineering geology, at the International Institute for Aerospace Survey and Earth Sciences (ITC), at Enschede, Netherlands;

(c) Training course on the application of remote sensing and GIS in studies of natural hazards of geological origin and in geological exploration, at the Groupement pour le développement de la télédétection aérospatiale, Toulouse, France.

35. In 1998 and 1999, UNESCO will organize, within the framework of the Man and the Biosphere (MAB) programme, training courses on remote sensing and GIS technologies for biosphere reserve managers in developing countries, and develop pilot projects on the operational use of GIS. Remote sensing and GIS technologies were introduced in biosphere reserve management by UNESCO in cooperation with Conservation International, Intel (United States of America) and Nippon Electric Company (Japan).

36. UNESCO, in cooperation with ITC and the World Wildlife Fund, will develop, in 1998, a training programme on remote sensing and GIS for the rehabilitation of panda habitats in China. The training programme will be for scientists and managers alike.

37. In the period 1998-1999, UNESCO will organize training activities in remote sensing and GIS technologies for environmental monitoring as a contribution to the Southern African Network for Training on the Environment project in Africa.

Fellowships

38. In promoting the development of indigenous capability, the United Nations Programme on Space Applications, in cooperation with the European Space Agency (ESA), administers three fellowships for a period of one year of research and study: one fellowship in remote sensing instrumentation at the European Space Research and Technology Centre at Noordwijk, Netherlands; and two in remote sensing information systems at the European Space Research Institute at Frascati, Italy. The Programme will also administer two long-term fellowships in space applications offered by China for the period 1998-1999.

39. With support from the Advanced Overseas Students Programme of the Government of China, ESCAP will provide long-term fellowships in 1998 and 1999 for training on GIS and remote sensing at the Wuhan Technical University of Surveying and Mapping.

40. FAO will continue providing fellowships and organizing study tours within the framework of remote sensing technology transfer activities of field projects in 1998 and 1999 and future years.

Provision of training materials or facilities

41. During the period 1998-1999, FAO plans to finalize and widely disseminate, in cooperation with national remote sensing institutions, additional brochures of the series "Remote sensing for decision makers". Two of those brochures, prepared in cooperation with the Centre royal de télédétection spatiale (Royal Centre for Spaceborne Remote Sensing) of Morocco, cover the subjects of aquaculture development and forest management applications.

42. UNESCO, through its Coastal Regions and Small Islands Unit, will continue the following activities in 1998, in 1999 and beyond:

(a) Participation in the European Commission project "Computer-aided system for tele-interactive learning in environmental monitoring" with regard to the development of training programmes on the use of remote sensing and GIS technologies in coastal zone management on CD-ROM;

(b) Production of distance learning materials on the circumpolar region using remote sensing imagery, in cooperation with remote sensing institutions of Canada, Denmark, the Russian Federation and the United States;

(c) Development of lesson materials on the use and cost-effectiveness of remote sensing technologies for coastal habitat mapping and resource assessment, in cooperation with the University of Newcastle and the University of Sheffield in the United Kingdom of Great Britain and Northern Ireland.

2. Expert services and survey missions to identify specific areas of applications relevant to a given country or group of countries and to carry out specific studies on pilot projects or to implement the projects with operational applications of technology

Provision of expert services and survey missions

43. In 1998 and beyond, the Office for Outer Space Affairs of the Secretariat, within the framework of the United Nations Programme on Space Applications, will continue to collaborate with the Department of Economic and Social Affairs of the Secretariat and ESA in follow-up activities related to the recommendations of the training courses on applications of European remote sensing satellite (ERS) data to natural resources, renewable energy and the environment, held at Frascati, Italy, in 1993, 1994, 1995 and 1997. The Office will continue to make efforts to identify and implement support mechanisms to enable scientists and applications specialists from Africa, Asia and the Pacific, and Latin America and the Caribbean to receive and utilize data from optical and radar satellites for resource management.

44. ECA will continue to provide, upon request, advisory services to member States and support to regional and subregional groupings, concerning the development and management of geographic information technologies. In 1998 and future years, particular attention will be given to ECA-sponsored regional training and service centres responsible for mapping, remote sensing and GIS applications. In this context, ECA will pursue actions to implement the decisions taken by the ECA Conference of Ministers in 1997 concerning the rationalization and harmonization of those ECA-sponsored regional training and service centres. The Conference decided that RECTAS and the Centre régional de télédétection should be merged in one new institution, while the African Organization for Cartography and Remote Sensing (AOCRS) and RCSSMRS would be retained as separate bodies. Those decisions were made following the study submitted by a team of experts selected by ECA during the first quarter of 1997. ECA will support and assist in the actions to be taken to realize the RCSSMRS vision for 2020, aimed at ensuring the relevance and sustainability of the Centre. AOCRS is considered as a useful and necessary coordinating and conceptualizing body to promote the use of remote sensing and GIS in the region and to facilitate interactions among member States.

45. During 1998, ECA will identify ECA-sponsored institutions with which it will develop partnership programmes in order to leverage resources and exploit synergies. Those institutions will be selected on the basis of the following key principles: relevance of programmes to the priority needs of the region; functionality in terms of demonstrated or potential operational capacity; and continued support by member States. ECA would seek alliances with its cooperating partners in order to supplement efforts by member States to transform those selected institutions into regional centres of excellence.

46. ESCAP will conduct consultative meetings through missions to donor agencies to arrange for the co-financing of regional GIS and remote sensing activities during 1998 and 1999.

47. The overall mission of the Environment and Natural Resources Service in the Sustainable Development Department of FAO is to contribute to and promote integrated environment and natural resource management and conservation in the context of sustainable agriculture and rural development. The Service provides technical support in the fields of remote sensing, agrometeorology, GIS, environment and energy, including advisory services and the formulation, backstopping and evaluation of field projects, to about 50 developing countries in Africa, Asia, Latin America and the Caribbean and central and eastern Europe. In addition, FAO provides support to the International Fund for Agricultural Development and the World Food Programme for their field

project activities and to the World Bank concerning guidelines, harmonization and standardization. Detailed information on FAO activities in the above field can be found at the World Wide Web site <<http://www.fao.org/sd>>.

48. FAO will continue to cooperate with the regional commissions and regional remote sensing centres in the efficient use of remote sensing technology for the mapping, assessment and monitoring of renewable natural resources and natural disasters. The priorities of this assistance will follow the recommendations of Agenda 21[1] of the United Nations Conference on Environment and Development, held at Rio de Janeiro from 3 to 14 June 1992, and the recommendations of the World Food Summit, held at Rome from 13 to 17 November 1996, as well as international conventions on desertification, biodiversity and climate change.

49. Following the successful completion of Phases I and II of the FAO/USAID project on the monitoring, forecasting and simulation of the Nile River, FAO will implement Phase III of the project during 1998 to assist the Government of Egypt in consolidating the results achieved in the earlier phases. Phase III of the project to further consolidate the Nile River Monitoring and Forecasting System and the related system of decision and control has been approved and will commence in 1998.

50. In June 1998, FAO will complete Phase II of its Regional Remote Sensing Project (RRSP) for the States members of the Southern African Development Community (SADC) with funding from the Government of the Netherlands. A three-year follow-on project for consolidation and strengthening of the SADC technical and institutional capacities for satellite-based environmental monitoring to support food security is currently being negotiated between FAO and the European Union. This project is designed to develop and implement food-security-related environmental monitoring activities at the regional, national and subnational levels. In addition to government agencies, the project involves non-governmental organizations as well as the private sector. FAO has completed its sister project for the countries in the region of the Intergovernmental Authority on Development (IGAD) in cooperation with RCSSMRS and with funding from the Government of France. This has resulted in a fully operational capacity for data processing and information product generation, including the preparation of food security early warning bulletins for the countries of the IGAD region, based on images from Meteosat and the advanced very high resolution radiometer (AVHRR) global area coverage and local area coverage of the National Oceanic and Atmospheric Administration (NOAA) of the United States. A similar project for western and central Africa has also been formulated.

51. FAO will continue its assistance to countries in the Caribbean subregion in establishing a land information system (LIS) based on aerial photography, satellite remote sensing and orthophoto mapping. At present, such assistance is being provided to Barbados, Belize and Trinidad and Tobago, and plans are being formulated for similar technical assistance activities to Brazil, Guyana, Haiti and Peru.

52. FAO will continue its assistance to countries in central Europe in increasing their capacities for agricultural and environmental applications of remote sensing and GIS. In particular, FAO will continue to offer advice on the use of remote sensing and GIS in planning and implementing agricultural land reform and in assessing and monitoring environmental damage. At present, such assistance is being provided to Albania, Czech Republic, Hungary, Poland and Slovakia.

53. FAO, through its Technical Cooperation Programme, will be assisting the Government of Slovenia in 1998 and 1999 in designing an integrated action plan for reforming the cadastral and land valuation systems. Similarly, FAO is assisting the Government of Yemen in the development of an environmental information system (EIS) for the collection, analysis and evaluation of natural resources in the country, thus facilitating data collection management, the distribution of existing and new data and the establishment of a trained human resource base.

54. FAO is implementing plans to establish during 1998 and 1999 a remote sensing and GIS-based environmental monitoring system in Baluchistan, Pakistan, to facilitate sustainable management of forest resources.

55. FAO will continue to contribute, with the use of remote sensing and GIS technology, to the development of schemes to control transboundary livestock diseases under the FAO Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) programme. Earlier studies relating normalized difference vegetation index data sets from ARTEMIS to tsetse distribution and land utilization types in Nigeria and Togo led to the establishment of an operational information system to define policies for African animal trypanosomiasis control. Remote sensing is used to define technical concepts for tsetse control in countries where high-resolution satellite images are available to discern land utilization types. A project is currently being prepared to design maps and GIS to assist 11 western African countries affected by onchocerciasis. GIS also plays a central role in the establishment of a global livestock geography, comprising the production of 10-kilometre resolution maps showing the distribution, over time, of the different livestock species worldwide.

56. In the field of agricultural statistics, FAO will continue to assist eight developing countries in satellite imagery techniques, which can be used for geographical stratification (subdivision in homogeneous land units), area frame sampling, regression estimates and area sampling surveys.

57. FAO is preparing a complete coverage of Sierra Leone with satellite image maps on the scale 1:100,000 to support the preparation of land-cover maps by national experts.

58. FAO has assisted the Government of China with the development of a national forest monitoring system with major remote sensing and GIS components. This system was completed in 1997, and the Government of China has requested FAO for assistance in extending this approach to the provincial level, for which a related document has been prepared.

59. Following the completion of a forest and land-cover map in analog and digital format on the scale 1:200,000 for Albania through the technical assistance of FAO, the World Bank has indicated its interest in the preparation of such maps on the scale 1:50,000.

60. During the period 1998-1999, UNESCO will provide expert services to several African countries in order to carry out pre-feasibility studies on the use of Brazilian satellite data for environmental monitoring.

Studies, pilot projects and operational applications

61. In 1998 and 1999, the Office for Outer Space Affairs, ESCAP, UNEP, FAO, the Intergovernmental Oceanographic Commission (IOC) of UNESCO and WMO will continue to contribute to the work of the Committee on Earth Observation Satellites (CEOS) as its affiliates.

62. The Office for Outer Space Affairs and other interested agencies will contribute to the implementation of the proposal entitled "Changing face of the Earth: an Earth observation treatise", which was submitted by the Indian Space Research Organization and endorsed by the Committee on Earth Observation Satellites (CEOS) at its plenary meeting in 1997. The main aim of the proposal is to review the efforts of space agencies and user organizations in the past 25 years, assess the capabilities of Earth observation systems and develop an invaluable reference document.

63. The Office for Outer Space Affairs will continue to provide technical assistance, as necessary, to the United Nations International Drug Control Programme (UNDCP) relating to the further development and

implementation of the space-related segment of the system for monitoring illicit crops, currently being proposed as part of the global plan for the elimination of illicit crops.

64. UNEP, through its GRID network, maintains linkages with providers and users of remote sensing and information technology applications in many countries to support an assessment framework for reviewing the state of the global environment and environmental issues of international significance. The GRID network now consists of 15 centres. Four of them, GRID Bangkok, GRID Geneva, GRID Nairobi and GRID Sioux Falls, have a UNEP staff presence. GRID Arendal is operated as a private foundation supported by the Government of Norway, through direct support to UNEP, in accordance with a memorandum of understanding between the partners. The other centres of the GRID network are at the following locations: the International Centre for Integrated Antarctic Research (ICIAR), Christchurch, New Zealand; the National Institute for Environmental Studies (NIES), Tsukuba, Japan; the International Centre for Integrated Mountain Development (ICIMOD), Katmandu, Nepal; the Instituto Nacional de Pesquisas Espacias (INPE), Saõ José dos Campos, Brazil; Esjberg, Denmark; the Canada Centre for Remote Sensing (CCRS), Ottawa; Warsaw; Ministry of the Environment, Budapest; Blue Plan office of the Regional Activity Centre of the Mediterranean Action Plan (MAP); and, most recently, Moscow. The results of the activities at those centres are circulated and transferred to its regional GRID centres at Bangkok, Geneva and Nairobi and form the basis of initiatives to be undertaken in 1998 and beyond for capacity development in data and database management in developing countries and in countries with economies in transition.

65. GRID centres continue to produce, add value to, and disseminate data sets useful for environmental assessment. UNEP will place greater emphasis on bringing the centres closer together and is considering the creation of a steering committee to oversee the development of a more integrated operation. The GRID centres continue to serve as the foundation for UNEP Environmental and Natural Resource Information Networks (ENRIN) projects, which initiate cooperation agreements with governmental and intergovernmental organizations in developing countries and countries with economies in transition to form environmental assessment and reporting networks. ENRIN projects are intended to constitute a mechanism designed to: promote the flow of information on environmental assessment between partner institutions and UNEP; provide for policy and planning consultations related to international environmental assessment and reporting; and provide a vehicle to catalyse and facilitate capacity-building of participating institutions.

66. UNEP, through GRID Geneva, has completed up-to-date databases of human population density and distribution for the Asian continent and the Russian Federation. The data sets were developed using GIS modelling techniques and the most recently available data on subnational administrative boundaries and human population at the most detailed administrative level. The GIS model is based on an "accessibility index" and the tendency of people to cluster near the existing centres of population and along the transportation infrastructure. The final gridded GIS data sets can be used for a wide variety of purposes including the assessment of human impacts on the landscapes. The report and results of the activities relating to the above are available at the Web site <<http://www.grid.unep.ch>>.

67. UNEP, through GRID Geneva, continues to undertake pilot studies on the use of GIS for preventing and resolving environmental conflicts. Experimental applications of GIS for such purposes were conducted for two study areas, the Lake Peipsi region of the Russian Federation and Estonia, and the Soca valley of south-western Slovenia. The studies aim at using GIS and the Internet and its World Wide Web as tools to collect and distribute relevant spatial data and information, and to inform all parties in a situation of potential environmental conflict of alternative solutions that can be displayed on-line. A report and results of those activities are available at the Web site <<http://www.grid.unep.ch>>. This work complements the previous work done at GRID Sioux Falls with Clark University.

68. UNEP will continue to operate its North American node of GRID in cooperation with the National Aeronautics and Space Administration (NASA) of the United States, the United States Geological Survey (USGS), the United States Forest Service (USFS) and the United States Environmental Protection Agency (EPA).

69. UNEP, through GRID Sioux Falls, will maintain access to the world-class expertise and unique facilities of the USGS Earth Resources Observation Satellite (EROS) Data Center, EPA, NASA and USFS, in the use of applied data and information technology for the benefit of developing countries. UNEP, through GRID Sioux Falls, has been active in the design, development and timely delivery of scientifically credible information products, recognizing that it is a formidable challenge to provide decision makers with information useful for environmental planning, management and policy formulation in a timely manner and understandable formats. UNEP, through GRID Sioux Falls, will continue to support decision-making needs in areas where the international community is actively involved, such as the Great Lakes Region of Africa and in dealing with the 1997 and 1998 forest fire disasters in south-east Asia.

70. UNEP will, through GRID Sioux Falls, conduct the biannual survey of spatial software technologies in 1999 to assess the status and trends of the technologies and to provide the information to developing countries.

71. UNEP will also use the facilities at GRID Sioux Falls to continue to derive methods for policy-relevant analysis using geospatial data and information.

72. UNEP will continue its efforts towards the completion of comprehensive and globally consistent data sets relating to global land cover, digital elevation, drainage basins, population and forest vegetation in cooperation with agencies around the world.

73. UNEP, through GRID Bangkok, is cooperating with the Branch Office of the United Nations High Commissioner for Refugees in Nepal to develop a database pertaining to environmental assessment and contingency planning for the areas around the refugee camps in eastern Nepal.

74. UNEP, through GRID Bangkok and GRID Sioux Falls, is cooperating with UNDP in a GIS remote sensing assessment of the Democratic People's Republic of Korea relating to agricultural relief and rehabilitation from recent disasters.

75. UNEP, through GRID Bangkok/UNEP Environment Assessment Programme—Asia and the Pacific (EAP-AP), continues to undertake land-cover assessment and monitoring studies with national agencies. Volumes 8-A, on Thailand, and 9-A, on Malaysia, were completed in 1997. During the period 1998-1999, the rate of completing such studies may be reduced because of persistent financial constraints.

76. Having completed the Soils and Terrain Digital Database (SOTER) on the scale 1:5,000,000 for Latin America, UNEP, together with the International Soil Reference and Information Centre and FAO, continue to advance the work and coverage of SOTER.

77. UNEP, through GRID Arendal, will continue to work with the Consultative Group on International Agricultural Research (CGIAR) to investigate cross-fertilization of applications of georeferenced data in agriculture and the environment to strengthen the performance of both organizations.

78. UNEP will continue to actively explore means of cooperation with UNDP on ways to apply the results of the integrated socio-economic and environmental database developed for Rwanda, by UNEP and Michigan State University in the United States, to databases of other countries and subregional aggregations.

79. Discussions are continuing between UNEP and the World Conservation and Monitoring Centre (WCMC) towards signing a memorandum of understanding in 1998 for WCMC to join the GRID network as a centre for biodiversity and conservation.

80. The UNEP metadata directory tool, which was developed by the GRID centres to maintain a record of the catalogue of worldwide GRID data sources, provides a stand-alone software system which allows users to enter metadata in a format compatible to large metadata systems. The package can be used on a stand-alone desktop computer. Although some improvements are desirable, it is still useful to small centres, and early test reports showed a favourable reaction. Because of severe resource constraints, further development of the system is temporarily suspended. The maintenance of the system was transferred to GRID Geneva early in 1998. Partners are sought to improve the system, at least until an adequate replacement tool can be found to service the needs of the GRID network and its partner organizations.

81. UNEP and UNESCO will continue to work with the Scientific Committee on the Problems of the Environment of the International Council of Scientific Unions (ICSU) in 1998 and beyond.

82. RCSSMRS of ECA will continue to collect, process and disseminate the data and information provided by the Early Warning System for Food Security project, which is supported by FAO and hosted by RCSSMRS. It also initiated the activities of phase two of the Regional Famine Early Warning System project, which will continue until 1999, using evapotranspiration and relative growth information derived from Meteosat.

83. In 1998 and 1999, ECA will undertake a series of technical studies and compile technical reports, including those listed below, which will deal with, as essential components, mapping, remote sensing and geographic information systems:

(a) Technical study on cadastral and land information systems for decision makers in selected African countries;

(b) Directory of education and training facilities in Africa in the area of geo-information;

(c) Technical report on the status of baseline spatial information in Africa, including programmes, resources, capacities and constraints.

84. During 1998 and 1999, ECA will expand the database on mapping and baseline spatial information on Africa, established in 1997, to cover all African countries and include other crucial indicators, such as gender participation.

85. During the biennium 1998-1999, ECA will finalize the project entitled "Digital cartographic inventory atlas".

86. ECA will continue to cooperate with FAO in planning, coordinating and implementing activities of the AFRICOVER project, in particular those related to the establishment of an African uniform geometric reference.

87. ESCAP is implementing the following projects:

(a) "Study on coastal zone environment management with emphasis on mangrove ecosystems", involving China, Philippines, Thailand and Viet Nam with funding from the Government of France, with the objective of integrating multiple-source information on coastal zones in a GIS, especially on mangrove ecosystems, which would lead to improving protection and use of coastal resources, further increasing the capacity of participating

countries for the analysis of coastal zone information as well as increasing cooperation between the participating agencies;

(b) "Coastal zone development and fishery environment analysis using remote sensing techniques" involving India and Bangladesh under the technical cooperation among developing countries (TCDC) programme;

(c) "Integrated development planning for poverty alleviation in arid zone of central Myanmar", which involves China and Myanmar also under the TCDC programme and is designed for the development of methodologies and models for dynamic analysis required for regional development planning.

88. ESCWA is conducting a study entitled "Assessment and promotion of research and development in the ESCWA member countries", which was discussed in an expert group meeting held in September 1997. At the request of the Higher Council for Science and Technology in Jordan, remote sensing and its applications in the study of desertification was also discussed as an important subject. It is envisaged that the study will elaborate the requirements for establishing a specialized network of institutions to cover a variety of remote sensing applications, such as urban planning and monitoring of environmental pollution and desertification.

89. ESCWA recently finalized a technical report on the assessment of water resources in western Asia. In the study, available hydrological data were utilized to evaluate known water resource parameters and to generate groundwater maps. Satellite images and photomosaics were also analysed with the use of GIS technology in order to study drainage patterns, to relate drainage basins to major fracture zones and to assess the potential of groundwater in fracture zone aquifers. The purpose of the correlation was to formulate options for the development and/or management of groundwater resources in western Asia, particularly in the case of aquifers shared by two or more countries. During the biennium 1998-1999, ESCWA will take follow-up action on the recommendations of the technical report, addressing primarily the need to develop a strategy for the utilization of shared water resources. The utilization of remote sensing technologies will be included in the strategy for designing specific projects, based on requests to be received from States members of ESCWA and pending the availability of funds.

90. The Sectoral Issues and Policies Division of ESCWA initiated an activity aimed at setting up a database for research and development institutions, industrial specifications and calibration facilities and information relating to transport systems in the States members of ESCWA. A prototype has been finalized, and the database, which will continue to be updated both in hard copy and electronic formats, will become part of information input on the ESCWA Web site in a suitable GIS format.

91. FAO is continuing its efforts to optimize the use of remote sensing, GIS and agrometeorological technologies and to effectively transfer and integrate their use into the activities of its member States for enhancing: the timeliness and cost-effectiveness of data collection; the inventory, monitoring and management of resources at various levels; and early warning and environmental monitoring.

92. FAO, under the coordination of its central GIS unit in cooperation with the relevant technical divisions, is supporting a number of projects with a major GIS component, including the following: (1) preparation of the GIS vector and raster versions of the FAO/UNESCO soil map of the world; (2) interpretations of the soil map; (3) preparation of the agro-ecological zones map of the developing countries; (4) study on crop and pasture zones for the IGAD countries; (5) development of maps of forest and wildlife reserves and other protected areas for the developing world; (6) estimation of available arable lands for the Agriculture Towards 2010 project; (7) analysis of the suitability of inland aquaculture sites of Africa and South and Central America for fish-farming potential; (8) statistics of the continental shelf and fishing areas of the oceans; (9) studies on soil suitability analysis for certain crops in Africa; (10) development of a pilot GIS database for evaluation of marine

resources; (11) site suitability and other analyses at the country level; (12) preparation of a subnational boundaries map of Africa; (13) preparation of a soil map on the 1:1,000,000 scale of north-east Africa; (14) study on coastal lowlands in the developing countries; (15) preparation of fish distribution maps for the Mediterranean; (16) preparation of maps for the World Food Summit; (17) water resources analysis; (18) preparation of soil maps for Mozambique, the Russian Federation and the United Republic of Tanzania; (19) study on potential food self-sufficiency at the high- and low-input levels; (20) preparation of dominant land resources types for Africa; and (21) preparation of nutrition profile maps. FAO field projects with a major GIS component are conducted in Afghanistan, Albania, Bangladesh, Brazil, Burundi, Eritrea, Lithuania, Malta, Pakistan, Peru and Tunisia.

93. FAO and ESA will continue their cooperation in developing appropriate techniques for the application of satellite synthetic aperture radar imagery to agriculture and forestry in developing countries. For that purpose, FAO and ESA concluded in early 1998 a formal agreement for closer cooperation within the framework of the ESA Data Users Programme. FAO and ESA are also currently reviewing their cooperation in the field of training in remote sensing and GIS. Similar cooperation has started between FAO and the Canada Centre for Remote Sensing. Studies to analyse the potential applications of images from the Canadian RADARSAT satellite for natural resource assessment, mapping and monitoring are being prepared.

94. FAO is continuing cooperation with the Government of France in developing operational methodologies for applications of high-resolution remote sensing data in international development projects through the implementation of pilot studies. Russian high-resolution satellite imagery is being evaluated for the same purpose. The results are published in the FAO Remote Sensing series of technical publications and brochures for decision makers. In addition, the Government of France is supporting FAO in the field of standardization and harmonization of methodologies on the use of remote sensing and GIS techniques.

95. Having concluded that global surveys of forest resources, such as those by the 1990 Forest Resources Assessment (FRA) project, if continued over time, would lend factual support to global environmental researchers and policy makers by providing detailed descriptions of the processes of change and the quantification of essential parameters on a reliable basis, and in view of the information needs of the international community, in particular, the need for studies on global changes, FAO intends to continue to build consistent and reliable time-series observations of forest and land use. FAO is currently preparing for a global forest resource assessment for the year 2000, FRA 2000, that will make extensive use of remote sensing and GIS, ranging from coarse resolution global coverage for forest cover mapping to high- and very high-resolution multi-date satellite imagery for surveying global and regional forest and land-cover changes. On the basis of the recommendations of an advisory panel of experts, following the successful completion of FRA 1990, FRA 2000 will be extended to include the subtropical, temperate and boreal forests. The FRA 2000 project includes a vigorous activity for country capacity-building, allowing countries to participate actively in the assessment process.

96. In this connection, FAO will consider the following recommendations in designing activities for 1998 and beyond:

(a) Statistical designs and analytical systems for series of transition matrices should be further developed:

(i) To use the auxiliary information such as the one on existing wall-to-wall forest classification based on AVHRR data (with 1-kilometre resolution) from NOAA, as well as other statistical and spatial information databases (Forest Resource Information System, GIS layers);

(ii) To improve estimates for change by stratifying parameters that would reduce the variance of forest area changes such as demography, economic indicators and infrastructure;

(b) Sound monitoring procedures such as interdependent remote sensing analysis should be further promoted to obtain location-specific information in order to assist decision-making;

(c) The vegetation classifications that have been adopted at the country level in response to local needs should be maintained, to the extent possible, compatible with global standards to allow for full contribution to the global base.

97. With the Government of the Netherlands, FAO is participating in developing the Forest Assessment and Monitoring Environment (FAME) concept. This programme aims at defining, developing and utilizing a satellite remote sensing capacity dedicated to providing real-time access to appropriate remote sensing data for supporting forest management and monitoring changes at the subnational and local level. During 1998, FAO is contributing to a comprehensive FAME user requirements study (URS), undertaken on behalf of the Government of the Netherlands by ITC, by conducting five country studies in Brazil, Cameroon, Costa Rica, Malaysia and Nepal and participating in FAME user requirements study workshops.

98. FAO, through ARTEMIS, which is to celebrate its tenth anniversary in August 1998, will continue the operational monitoring of seasonal growing conditions and vegetation development over Africa, based on Meteosat and NOAA-AVHRR data, for use in early warning for food security and desert locust control. It includes routine distribution of ARTEMIS images by electronic means to authorized users at FAO headquarters and at the regional and national levels. FAO, through technical assistance from its headquarters and its regional projects, will also continue to support the establishment, or improvement, of local reception and/or processing systems using low-resolution environment satellites, including the development of improved interpretation techniques and user-friendly software. The ARTEMIS system was significantly upgraded in 1996 to better satisfy the expanding needs of its users, as well as those of the scientific community. The rainy season performance assessment capability of the system, based on the use of the Geostationary Meteorological Satellite data, was expanded to cover east Asia in 1996. During 1998, its NOAA-AVHRR-based vegetation index coverage will be expanded to include South and Central America, through cooperation with the Goddard Space Flight Center of NASA. An ARTEMIS Web site, as an integral part of the FAO Sustainable Development Department Web site, "SD-Dimensions", will be available in mid-1998. For expanding the capabilities of the ARTEMIS system in support of food security, locust control, animal health and forestry applications, FAO is currently negotiating with the European Commission concerning access to the forthcoming VEGETATION data from the Système pour l'observation de la Terre (SPOT)-4 satellite and with NASA concerning access to the forthcoming MODIS data from the Earth Observing System (EOS)-1 satellite.

99. FAO will continue its work on sustainable management of agricultural, forestry and fishery natural resources and on its Global Information and Early Warning System (GIEWS) on food and agriculture with a view to increasing the use of remote sensing inputs and their integration with other inputs in GIS. The integrated computer workstation of GIEWS, developed by FAO with financial support from the European Union, is capable of integrating remote sensing, agrometeorological, socio-economic and statistical data and news reports on a common geographic basis and is now fully operational in GIEWS. Its use is being expanded to the regional level in the SADC region.

100. GIEWS has the unique responsibility of providing early warning of food security emergencies for the whole world. Remote sensing data from ARTEMIS and agrometeorological data and information are used as input in the evaluation and assessment process, both at the data and the product levels. The development of models to integrate satellite and agrometeorological data with socio-economic and nutritional information, using GIS technology, is currently being finalized under the GIEWS risk-mapping project. The project is being implemented by FAO in partnership with the Save the Children Fund in London and executed by GIEWS with financial assistance from the European Community.

101. One of the main activities of the Environment and Natural Resources Service of FAO is the technical backstopping of the national and regional early-warning systems for food security, in which agrometeorology is one of the three major components. In this field, development of advanced tools for integrating remote sensing imagery and GIS techniques is widely pursued. In particular, spatial interpolation of meteorological variables, which is one of the most difficult tasks in geostatistics, is dealt with by one of the tools provided using the GIS software WinDisp3, distributed widely among developing countries for satellite imagery analysis.

102. The FAO project "Support for early warning and food security information in Somalia" will assist the Food Security Assessment Unit in developing agricultural statistics and databases through an initiative to complement the project with valuable remote sensing inputs. A project proposal, called "AGROSCENE", for the assessment of crop and range land cover/use for Somalia using remote sensing outputs from AFRICOVER activities will be implemented. The above assessment is expected to provide an updated and accurate baseline of crop and range land statistics, namely areal extension of different classes of land cover and land use. The outcome will be in the form of tables and simple maps.

103. In cooperation with a number of partners and with financial support from the European Union, FAO has designed an Integrated Coastal Analysis and Monitoring System (ICAMS). ICAMS will support the management of ecosystems of coastal zones by producing maps of the water quality and coastal zone resources, based on a time-series analysis of oceanographic satellite data from the SeaWifs and future ENVISAT satellites.

104. FAO will continue to assess existing forest resources and trends in deforestation, forest degradation and plantations. A number of pilot studies will be undertaken to test new data and to develop appropriate methodologies. An operational work plan is being prepared by the Joint Research Centre at Ispra and by FAO in order to integrate the use of NOAA-AVHRR defined by Tropical Ecosystem Environment Observations by Satellite and the methodology used in the FRA project and AFRICOVER.

105. Within the framework of its inputs to ongoing and planned global environmental programmes such as GTOS, which is designed to improve the quality and use of terrestrial ecosystem data and information on a global scale, FAO will continue its cooperation with organizations within the United Nations system, specialized agencies and other international organizations. The primary objective of GTOS is to provide policy makers, resource managers and the research community with data needed to detect, quantify, locate and give early warning of changes in the global capacity of terrestrial ecosystems to support sustainable development and improvement of human welfare, relating to land quality, availability of freshwater resources, loss of biodiversity, pollution and toxicity and climate change. The implementation of GTOS is closely linked with that of GCOS and GOOS, which are co-sponsored by UNEP, UNESCO, WMO and ICSU. GTOS, through its secretariat at FAO headquarters and its Steering Committee, is actively developing a Global Terrestrial Observing Network (GT-Net), the Terrestrial Ecosystem Monitoring Sites meta-database and plans for joint regional workshops with GCOS for the formulation of regional activities. Closer cooperation is also envisaged with CEOS in the framework of the Integrated Global Observing Strategy. FAO also cooperates with UNEP and UNESCO by participating in working groups on the harmonization of land-use and land-cover classification and provides technical support to the follow-up of the Conference of the Parties for the Convention on Desertification.

106. FAO is contributing to the preparation of four projects of the Observatoire du Sahara et du Sahel (OSS):

(a) Assessment and monitoring of land degradation and desertification in countries in northern Africa, with the Centre régional de télédétection des États de l'Afrique du Nord;

(b) Harmonization of the uses of NOAA-AVHRR and Meteosat data for environmental monitoring;

(c) Participation in AFRICAGIS, the main international forum on GIS and environmental information system technologies in Africa;

(d) Setting up of a long-term ecological observatory network, Réseau d'observatoires de surveillance écologique à long terme, in Africa within the framework of GTOS activities.

107. FAO is continuing to cooperate with UNDCP on pilot projects to determine the location of narcotic crop cultivation sites using satellite remote sensing data. Planned studies will use high-resolution data from new optical and microwave Earth observation satellite systems. Increased use of GIS and expert systems for modelling and forecasting is also planned for 1998 and beyond.

108. With the support from the Government of Belgium, FAO is implementing the Reconnaissance and Management System of the Environment of Schistocerca (RAMSES) system within the framework of its EMPRES programme. The objective of RAMSES is to improve the use of Meteosat and NOAA-AVHRR data for the early detection of locust areas in Africa in association with locally collected, georeferenced field data and the historical desert locust database which resides at FAO in a dedicated GIS called SWARMS.

109. The AFRICOVER project, which started in 1995, continues for another three years, in order to ensure the establishment of a land-cover digital database for and by each national and regional African competent body and to produce land-cover maps on the scale 1:250,000 (1:1,000,000 and 1:100,000 in certain cases), using the same geographic references and projection system in Africa, as well as a common harmonized legend, with updated information on drainage, toponyms, roads and land-cover features, to list a few. It will be implemented in African regional and national remote sensing centres and mapping agencies under the supervision of FAO. Preparatory and methodological work has resulted in a number of publications on mapping guidelines and standards. Since 1996, the World Bank, together with FAO, has been designing a major project in central Africa, REIMP. The project aims at improving and strengthening the planning and management of natural resources in the Congo basin by providing various stakeholders with appropriate environmental information. The project involves some 100 organizations from the public and private sectors as well as non-governmental organizations, working in a national and regional network structure. FAO is the lead agency for the normative as well as technical control activities of the project, which is supported by a multidonor fund involving Belgium, Canada and France as well as the World Bank, the European Union and the Global Environment Facility (GEF).

110. In 1998 and beyond, FAO envisages the increasing use of GPS in surveys and the integration of remote sensing data into GIS-based land resource information systems. FAO is considering using remote sensing to assess and monitor the progress of soil and water conservation works carried out in the field within the framework of national programmes assisted by WFP.

111. The Investment Centre of FAO uses remote sensing data to supplement or update geographic information needed for the preparation of development projects. In addition, it is incorporating more remote sensing components into projects concerned with the development and management of natural resources. Guidelines for the use of remote sensing in the design of investment projects are now ready for publication.

112. The Land Regulation Task Force, which has been established by several divisions within FAO, continues to coordinate activities related to LIS, which depends on remotely sensed data, primarily aerial photographs and orthophotomaps, to construct effective multi-purpose cadastral and land record systems for land registration and administration.

113. The Fisheries Department of FAO conducts remote sensing activities for fisheries. Satellite remote sensing, in particular when combined with GIS, is increasingly being used in marine and inland fishery projects, including aquaculture siting. Pilot projects on the use of AVHRR data for inland fisheries are in progress.

114. UNESCO will continue to cooperate with UNEP, FAO, WMO and the International Geosphere-Biosphere Programme (IGBP) (Global Change) of ICSU, in the development of GTOS. Two activities within the MAB programme of UNESCO are of special relevance: the International Network of Biosphere Reserve, which focuses on the development of a GT-Net, and the Diversitas Programme, concerning biodiversity monitoring.

115. During the period 1998-1999, the Intergovernmental Oceanographic Commission (IOC) of UNESCO will continue to contribute to the work of CEOS concerning the development of user requirements for sensors and data management systems within the framework of the GOOS programme.

116. Within the framework of its MAB programme, UNESCO continues to develop, in cooperation with UNEP, the National Institute for Research in the Amazon of Brazil and the Institut français de recherche scientifique pour le développement et la coopération, a multidisciplinary research programme on the economic and ecological sustainability of tropical forest management in the central Amazonian region. Remote sensing technologies will be used in natural resource surveying and mapping.

117. Within the framework of the MAB programme, UNESCO cooperates with OSS in a project regarding the establishment of an ecological observatory network, ROSELT, in Africa. In this respect, UNESCO will introduce the use of space technology for environmental monitoring.

118. Within the framework of the GARS programme, organized jointly with the International Union of Geological Sciences, UNESCO will implement the following activities in 1998 and 1999:

(a) Third phase of the GARS-Africa project concerning the development of a regional remote sensing user network in Africa in cooperation with the Royal Museum of Central Africa (MRAC) of Belgium; this activity is linked with the Pan-African Network for a Geological Information System (PANGIS) project, to which remote sensing data interpretation capabilities have been added. The Centre international pour la formation et les échanges géologiques (CIFEG) of France and MRAC of Belgium cooperate with UNESCO in the PANGIS project, which currently has 33 African member countries;

(b) Final phase of the GARS-Latin America project, which focuses on mountain hazard and landslide mapping of the Andean subregion using microwave space-borne sensor data and GIS technology; the results of this project will be published in 1998;

(c) Operational phase of the GARS-Asia project regarding the monitoring of four volcanic test sites in the Philippines; the aim of this project is to develop a new methodology for volcanic hazard assessment and prediction using multisatellite data and GIS technologies.

119. UNESCO cooperates with the Council of Europe, the European Commission and ESA in implementing the "Space techniques for major risks management" programme.

120. UNESCO and UNDP will launch in 1998 a three-year remote sensing and GIS programme entitled "Sustainable development of the South Valley and Sinai", in collaboration with the Geological Survey of Egypt and the Egyptian National Authority for Remote Sensing.

121. UNESCO will continue to monitor selected cultural sites and historical cities inscribed in the World Heritage List, such as Angkor in Cambodia and Moenjodaro in Pakistan, using remote sensing and GIS technologies, in close collaboration with relevant national authorities and international institutions such as ITC, Netherlands.

122. Within the framework of its Space Archaeology Programme, UNESCO will continue to develop cooperation with space agencies, such as NASA of the United States, NASDA of Japan and the Centre national d'études spatiales of France, for the implementation of field research activities such as archaeological site prospections and study of archaeological sites in their geographical environment.

123. UNITAR, in cooperation with OSS, has designed and implemented a programme on environmental integrated information systems, which led to the Desertification Circulation Information System within the framework of the Convention to Combat Desertification (CCD). The idea has further evolved and is now applied to environmental issues in a broader perspective, to develop Information Systems to Monitor the Environment through the Internet (SISEI). This new concept relies on the combination of a participatory institutional approach with wide dissemination of information and communication technologies. At the technical level, projects implemented under the programme relate to database management and integration of multisource data, including remote sensing products in GIS, and information sharing through the Internet services. The first SISEI will be set up during the period 1998-1999 in Benin. Negotiations are under way for similar initiatives in Côte d'Ivoire, Gambia, Madagascar, Mali and Senegal.

124. UNITAR established, in 1996, the Desertification Information Systems (DIS) programme through pilot projects implemented in Mali, Senegal and Tunisia. The programme has been endorsed by regional African organizations, such as the Comité inter-états de lutte contre la sécheresse au Sahel, the Arab Maghreb Union, IGAD and SADC, as well as member States and the secretariat of CCD.

125. A number of sessions and national workshops organized by UNITAR on increasing subregional awareness resulted in a three-year programme for the period 1998-2000 through which African States and regional organizations will create their own DIS within the framework of CCD.

126. The UNITAR pilot project on urban information systems implemented at Cebu, Philippines, led to the integration of shared urban databases in a municipal GIS. Combined with a comprehensive government profile, it allows an improved decision-making process in urban planning and management.

3. Dissemination or exchange of information on the status of technology or operational systems through meetings or publications and/or policy coordination

Dissemination of technological information

127. UNEP, through GRID Bangkok, printed 500 copies of the Asia Pacific Mozaic based on 1993 NOAA-AVHRR high-resolution picture transmission data obtained from the EROS Data Center of USGS, the National Environmental Satellite, Data and Information Service (NESDIS) of NOAA, the National Research Council of Thailand, SMA/SMC of China, GRID Tsukuba, CERES and Chiba University in Japan. Those copies are available for distribution.

128. UNEP, through the Desertification Control Programme Activity Centre and GRID Nairobi, completed a new version of the *World Atlas of Desertification*, which is now available for distribution.

129. UNEP, through GRID Sioux Falls, will continue to disseminate information related to the latest developments in information technology, including remote sensing, GIS data management and applications and Internet technologies.

130. In 1998 and 1999, UNEP will strive to make more of its published and database materials available on the Internet and the World Wide Web. While GRID Bangkok, GRID Geneva, GRID Sioux Falls, GRID Arendal and GRID Nairobi were providing, as the major centres, Internet and World Wide Web access and File Transfer

Protocol access at the end of 1997, GRID Sioux Falls continues to lead the activity in data provision, and from its award-winning Internet site, over a million of freely available files have been transferred during the past two years. UNEP will continue to promote such access to important data and information.

131. In 1998 and 1999, ECA will continue to publish its cartographic and remote sensing bulletin.

132. ESCAP will continue to publish the biannual *Asian-Pacific Remote Sensing and GIS Journal* in 1998 and 1999.

133. ESCAP will also prepare, publish and disseminate the following special publications as part of its regular information service activities:

(a) Reports of pilot projects conducted under the regional programme on remote sensing and GIS applications by member States, in 1998 and 1999;

(b) *Guidelines on GIS Standards and Standardization Procedures*, in 1998.

134. The Coastal Regions and Small Islands Unit of UNESCO will publish in 1998 a remote sensing handbook for tropical coastal management.

135. UNITAR, in cooperation with OSS, has edited a CD-ROM on DIS, containing information on the concept and goals of the joint programme implemented by UNITAR and OSS (A/AC.105/631, para. 154), as well as the approach taken to implement projects through the programme. It also provides information on concrete cases of the DIS for Senegal and the DIS for OSS, in which multi-source data, from UNEP GRID, FAO, WMO and others, are integrated in a GIS accessible through the Internet. CD-ROM is available for distribution on request (http://www.unitar.org).

136. The next workbook of the UNITAR Exploration in Geographic Information Systems Technology series will be issued in January 1999. Like previous volumes, it will contain a review paper and a series of GIS exercises relevant to a specific application. In the workbook, the use of GIS for urban management will be explored.

Elaboration of strategies or plans for future applications programmes or systems and/or policy coordination

137. The Office for Outer Space Affairs plans to hold from 18 to 21 October 1998, at Gaborone, a Workshop on the Evaluation of the series of the United Nations/Sweden International Training Courses on Remote Sensing Education for Educators. The workshop will seek to determine the future direction of the course.

138. ECA will organize in September 1998, at Addis Ababa, an ad hoc expert group meeting on integrated geoinformation systems for decision makers, with special attention to cadastral and land information systems.

139. In October 1999, ECA will organize and service the Tenth United Nations Regional Cartographic Conference for Africa, either as a special conference or as a subcommittee of the Committee on Information Development, recently established as a subsidiary body of ECA, following the reform of the intergovernmental machinery of the ECA secretariat.

140. ESCAP will hold the annual meeting of the Regional Working Group on Remote Sensing, Geographic Information System and Satellite-based Positioning at Bangkok in May 1999. The annual meeting in 1998 was held at Cebu, Philippines, from 18 to 20 May 1998.

141. UNESCO will support the following events in 1998:

(a) Colloquium on the use of space technology in environmental management of the Mediterranean region, organized by the European Association for the International Space Year in Greece;

(b) Second regional conference on "Integrated Development and Application of Remote Sensing and GIS for Sustainable Development in Africa", organized by the African Association of Remote Sensing of the Environment in Côte d'Ivoire.

142. Within the framework of its MAB programme, UNESCO will synthesize and publish the most recent GIS case studies on biosphere reserve management in developing countries. A task force for biosphere reserve data management is being set up to formulate strategies, tactics and technical protocols for the improvement of biosphere reserve data management, including the use of GIS and remote sensing technologies, and to plan future activities.

4. Capacity-building

143. The Office for Outer Space Affairs, within the framework of the United Nations Programme on Space Applications, is advising UNIDO on a project proposal for the management of large marine ecosystems, with emphasis on protection of human health and building capacity for marine resource development and environmental protection in the Gulf of Guinea in west Africa.

144. The UNEP Division of Environmental Information and Assessment (DEIA) was further modified to rationalize its information activities into two areas: Environmental Information Networking (EIN) at the institutional level, concerned with data and information for state-of-the-environment (SOE) assessment and information; and Environmental Information Services (EIS), dealing with communications as well as dissemination and exchange of scientific and technical environmental information. The EIN unit continues to administer GRID and ENRIN activities in support of the global assessment and reporting function of UNEP. The EIS unit administers the UNEPNet (see paragraph 182 below) and the International Environmental Information Exchange and Referral System (INFOTERRA) programmes (see paragraph 183 below) and has responsibility for the institution of Mercure.

145. The UNEP series of Global Environmental Outlook reports is predicated on an interactive assessment process which has four main thrusts, namely, assessment and report coordination, networking, data and communications. In developing countries and countries with economies in transition, the data gap continues to be a major issue. UNEP capacity-building activities are restricted to those institutions which are active in expanding their data and information assessment network serviced by GRID and ENRIN. UNEP network capacity-building and servicing activities are aimed, as appropriate, at identifying the needs of partner institutions, designing projects and formulating proposals to meet those needs and assisting the institutions in mobilizing resources to implement the projects. In return, UNEP seeks to enter into agreements on data access and exchange in the service of international assessment and reporting.

146. In Africa, UNEP continues to build networks and serve as a catalytic force for capacity-building within the framework of the ENRIN project with the support of GRID Nairobi. A dialogue is ongoing with IGAD on a network strategy for the IGAD countries.

147. UNEP maintains cooperation with SADC in the development of networks to support environmental and land management in the region. A joint SADC/UNEP-ENRIN initiative is aimed at strengthening national and subregional institutional capacities for environmental data and information management to support decision-making processes. The initiative comprises the following two components which are considered as

important inputs to enhance environmental management practices in the region and the member States: SADC Regional Database Development and Networking, implemented by the SADC Food Security Technical and Administration Unit for SADC-ELMS; and EIS Training and Education, providing SADC and member States with necessary support to establish and strengthen in-country EIS training and education infrastructure to meet the growing demand for such skills in the specialized areas of environmental assessment and reporting as well as the associated data and information management.

148. UNEP is working on a similar initiative for the subregional organization of the Permanent Interstate Committee for Drought Control in the Sahel. UNEP, in collaboration with the Agrometeorology and Operational Hydrology and Their Applications (AGRHYMET) Centre, elaborated a Regional EIS and Networking Implementation Strategy, focusing on the following four strategic areas: institutional capacities; information exchange networks; harmonization and standardization of data and assessment and monitoring tools, including those for national and regional SOE reporting; and in-country training capacities. The strategy has been formulated as a project proposal and submitted to potential donors for funding.

149. UNEP continues to provide technical backstopping assistance to Eritrea, Ghana, Kenya, Lesotho, Uganda, United Republic of Tanzania and Zambia. Continuing cooperation in the development of environmental information systems in Africa is coordinated through the Advisory Committee on Environmental Information Systems in Sub-Saharan Africa. Sponsored by the World Bank, UNEP, UNDP/Office to Combat Desertification and Drought, Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation), USAID and the Norwegian Agency for International Development, the Advisory Committee provides a forum for coordination and the exchange of ideas.

150. UNEP also cooperates with the FAO Regional Office for Africa, at Accra, in strengthening institutional capacities for developing coastal and marine environmental databases for some countries along the west African coast, such as Gambia, Ghana and Guinea. UNEP and the Programme on EIS in sub-Saharan Africa also cooperate more specifically with countries in west Africa to develop guidelines for data standards and harmonization to facilitate the exchange and use of information within the region.

151. UNEP continues to develop data access agreements in Asia and the Pacific with cooperating institutions in the Association of South-East Asian Nations, the Mekong River Commission, the International Centre for Integrated Mountain Development (ICIMOD), the South Asia Cooperative Environment Programme, at Colombo, and the South Pacific Regional Environment Programme, as well as other small intergovernmental organizations. Regular meetings are held with the principal partners to ensure that the agreement will take a complementary approach to capacity-building for assessment and reporting, including data management. Cooperation is continuing with the ESCAP Statistics and Natural Resources Division, the UNDP Regional Office for Asia and the Pacific, the Asian Disaster Preparedness Centre, ICIMOD, the International Crop Research Institute for the Semi-Arid Tropics and the International Rice Research Institute.

152. UNEP, through GRID Bangkok, in implementing EAP-AP, organized a number of institution-specific training courses on GIS for forest monitoring and executive introduction to GIS. Funds permitting, such institution-targeted courses will continue in 1998. UNEP, through GRID Bangkok/EAP-AP, proposes to organize two targeted training courses in 1998, one on GIS, in Thailand, and the other on SOE on the Internet, in China.

153. The UNEP/ENRIN programme for central and eastern European countries with economies in transition continues through GRID Arendal. Three new project proposals on needs assessment and capacity-building have been formulated for the region, and a new GRID centre was opened within the Ministry of the Environment at Budapest. The pilot phase for the development of a GRID centre in the Russian Federation, GRID Moscow, at the Federal Centre for Geo-Ecological Systems of the State Committee on Environmental Protection is being

overseen by GRID Geneva. The GRID Moscow office is to be formally opened on World Environment Day in Moscow in late 1998.

154. UNEP continues to place strong emphasis on inter-agency cooperation at all levels in the subregion of central and eastern Europe, particularly with the Office of the United Nations High Commissioner for Refugees (UNHCR), UNITAR, ECE, UNDP, the WHO European Centre for Environment and Health, the World Bank, the Regional Environmental Centre at Budapest, the Organisation for Economic Co-operation and Development, the European Environment Agency, GEF, Poland/Hungary Aid for the Reconstruction of the Economy (PHARE), Community programme of technical assistance for the Commonwealth of Independent States and Georgia and WCMC.

155. UNEP, through GRID Geneva and the MAP/Blue Plan office at Sophia Antipolis, France, is preparing a new strategy for ENRIN capacity-building in the Mediterranean region. Since 1995, the MAP/Blue Plan office has been developing a series of environmental "observatories" in several Mediterranean countries which, like national GRID centres, have the capacity to collect, manage, analyse and distribute various types of environmental and socio-economic data sets and information. UNEP plans to support this effort with the technical capacity of GRID and the extension of ENRIN programme activities to the Mediterranean through the development of new proposals for donor and partnership funding.

156. UNEP activities in networking and data management capacity-building are continuing in Latin America and the Caribbean, although they are constrained by a lack of finances. The UNEP/Centro Internacional para la Agricultura Tropical (CIAT) project on indicators has completed its first phase with the production of a CD-ROM which is available in Spanish through CIAT. The second phase of the project will commence in 1998, with support from the World Bank, CIAT and UNEP, to test the methodology of the project, utilized for the region at national and subnational levels, and to improve the regional indicators.

157. Subject to the availability of finances, UNEP will continue to seek opportunities to offer short-term fellowships to appropriate persons from developing countries to work at GRID Sioux Falls and to develop or analyse data sets relating to environmental issues in their home countries.

158. ESCAP is in the last year of the implementation of the multidisciplinary megaproject entitled "National capacity-building for sustainable environment and natural resources management through research and studies on the uses of data from Japan's Advanced Earth Observing Satellites (ADEOS)", which aims at contributing to sustainable environment and natural resource management in the ESCAP region through building national capacity in using advanced satellite remote sensing technology and at developing a network of specialists competent in the use of ADEOS data. The project is being implemented by 19 teams of specialists from 14 ESCAP developing countries (Bangladesh, China, India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand and Viet Nam).

159. ESCAP will undertake technical advisory service and consultancy missions in its member States on the applications of GIS and remote sensing in integrated natural resource and environment management in 1998 and 1999. Those missions will assist in promoting space technology applications for sustainable development, with emphasis on policy issues and institution-building, and in strengthening national capabilities in space applications or technology development, with emphasis on remote sensing and related GIS applications.

160. FAO, through its AFRICOVER project, contributes to strengthening African capacities in advanced geographic information technologies for the environment and natural resources inventory, monitoring and management. The value of the AFRICOVER project is not merely in the usefulness of the maps and databases to be produced; the elaboration of such maps will initiate capacity-building efforts in Africa through the development of national information systems for the environment and natural resources, crop assessment and

food security, land management and large watershed management, preparation of investment field projects and locust and desertification control.

161. The main emphasis of the activities of FAO in the field of agricultural applications has been placed on the systematic enhancement of the national capacities of existing institutes whose mandates lie in implementing activities involving remote sensing, the monitoring and mapping of natural resources. The current tendency is to implement projects whose operational capacity has been vital to larger programmes. The following activities will continue to be carried out in the period 1998-1999 for the above-mentioned purposes:

(a) *Nile basin*: Through the effective development of an operational remote sensing capacity to receive Meteosat satellite imagery for the Blue and White Nile data, Meteosat-derived rainfall information is calibrated and fed into forecasting models to provide up to three weeks' advance notice of river flow at critical points along the Blue Nile;

(b) *Egypt*: Egypt has been the focal point for two other important institution-building projects assisted by FAO. The first project is located at the Desert Research Centre, which has the capacity to monitor the delicate ecological balance of Egyptian rangelands. The Centre will also supply data to the OSS programme. The second project is located at the Soil and Water Research Institute of the Ministry of Agriculture. Remote sensing is also used for operational soil mapping within the delta, and regular crop acreage estimates are made for the major crops each season;

(c) *Côte d'Ivoire*: FAO is involved in the preparation of an environmental information policy with the World Bank;

(d) *Afghanistan*: A follow-up to the project for land-cover inventory on the scales 1:100,000 and 1:250,000 is the joint FAO/UNDP formulation of a Programme Management Information System (ProMIS) in response to the information requirements of UNDP and the United Nations Office for the Coordination of Humanitarian Assistance to Afghanistan. ProMIS will enable access to relevant information for planning, coordination, implementation, monitoring and evaluation of humanitarian, emergency and development assistance programmes for Afghanistan;

(e) *Pakistan*: FAO continues to assist in the establishment of an environmental monitoring unit at the forestry department of the regional government of Baluchistan and the installation of hardware and software and a database for environmental monitoring;

(f) *Eastern Africa*: FAO is conducting a pilot study on the identification of aquaculture sites, using NOAA-AVHRR and European remote sensing satellite (ERS)-1 data.

162. The project proposal for a Land Cover Map and Digital Database of Africa, which was formulated by FAO and endorsed by the United Nations Inter-Agency Meeting on Outer Space Activities, has become AFRICOVER and is operational for eastern Africa with support from the Government of Italy. It is being submitted by African countries to potential donors.

163. FAO should retain the capability to play an active role in building the capacity of and otherwise strengthening national and regional bodies, especially in developing countries, through:

(a) Training for decision makers and project managers;

(b) Support to national and regional centres (consultancy for equipment, maintenance, organization, training courses for technical staff);

(c) Technology transfer from headquarters to countries and regions (early warning systems, projects, pilot action studies);

(d) Support to national environment administrations concerning environmental information systems and environmental policy formulation.

164. Within the framework of a cooperative research project with the Libyan Arab Jamahiriya, UNESCO proposes to strengthen the remote sensing and GIS infrastructure of the country to improve the study of its natural resource potential, especially that of the southern region.

165. UNESCO will initiate activities with the Central American Centre for the Coordination of Natural Disaster Prevention and ITC, Netherlands, within the framework of the Coordination Programme for Disaster Reduction through Sustainable Development, with a view to strengthening the technical and scientific capabilities of countries in the Central American region. Those activities will include processing and analysis of geo-hazard information using remote sensing and GIS technologies as well as decision support systems (DSS).

166. UNITAR initiated in 1997 a programme to strengthen municipal capacities in information management through pilot projects at Cebu, Philippines, and at Dakar. Popular urban information systems, which aim at establishing a participatory process as well as dissemination and sharing of information between all stakeholders in the city, will be implemented in 1998 and 1999 in major west African cities through pilot projects.

B. Communications and navigation

1. Education and training programmes

Training courses, workshops and seminars

167. The Office for Outer Space Affairs, within the United Nations Programme on Space Applications, plans to hold, in the second half of 1999, a training course on the cooperative information network linking scientists, educators, professionals and decision makers in Africa (COPINE). The objectives of the training course would be to equip the operators of COPINE facilities with necessary skills, particularly in operational requirements, maintenance and repair, as well as to increase the awareness of the users and to provide them with training in the use of COPINE services.

168. ECA will organize the following conference, symposium and workshops in 1998 and future years:

(a) Global Conference on Connectivity in Africa, bringing together policy makers, regulators, intergovernmental and non-governmental organizations and the private sector, including Internet service providers, to be held in collaboration with the World Bank and the African Development Bank in June 1998;

(b) Symposium on the importance of the African Information Society Initiative (AISI), utilizing information and information technology to build competitiveness of African economies and society as well as policy reforms to provide a supportive environment, to be held three times each year in 1998 and 1999;

(c) Three workshops on the importance of AISI, utilizing information and information technology to build competitiveness of African economies and society;

(d) Two workshops on developing African information content and building African Web sites;

(e) One workshop on the use of information technology to access African development information.

169. ESCAP will hold a Regional Seminar on Satellite-based Multimedia Technology Applications to Promoting Rural Development at New Delhi, from 29 September to 1 October 1998.

170. ICAO is conducting activities to face new challenges concerning human resources involved in the introduction of advanced satellite-based communications, navigation and surveillance and air traffic management (CNS/ATM). ICAO, which recognizes that an adequate number of people should be trained or retrained in the use of new technologies, addresses human resource planning and training issues through its TRAINAIR programme, which provides a mechanism for cooperation among training centres for the development of the many new training courses that are required. A seminar on the implementation of GNSS was organized by ICAO for the region of Africa and the Indian Ocean at Nairobi in May 1998. Similar seminars will be organized for other regions in the future.

171. The ITU Radiocommunication Bureau (BR) will be organizing world seminars every two years and regional seminars in the intervening years on frequency management, the use of the geostationary satellite orbit and preparatory activities for the radiocommunication conferences with a view to providing technical assistance to the participating countries.

172. The ITU Telecommunications Development Bureau (BDT) conducts, within the Buenos Aires Action Plan for Global Telecommunications Development, round tables and seminars on telecommunication policies, strategies, research and development for developing countries, training of staff from developing countries in various areas of telecommunications, use of GMDSS and mobile satellite communication, in particular global personal communications by satellite (GMPCS).

173. ITU has four projects for the establishment of centres of excellence in telecommunications in Africa, Asia and the Americas. The centres will play an important role in strengthening competencies in the field of telecommunications by the different levels of management in the areas of policy, regulatory activity, management (frequency management) and technology.

Fellowships

174. The United Nations Programme on Space Applications, in cooperation with ESA, administers two fellowships, one for research and study on space antennas and electromagnetics and the other for research and study on communications systems at the European Space Research and Technology Centre at Noordwijk, Netherlands.

175. ITU continues to provide fellowship support for candidates from developing countries to participate in its meetings.

2. Expert services and survey missions to identify specific areas of applications relevant to a given country or group of countries and to carry out specific studies on pilot projects or to implement the projects with operational applications of technology

Provision of expert services and survey missions

176. In the period 1998-1999, the Office for Outer Space Affairs, within the framework of the United Nations Programme on Space Applications, will continue to provide technical advisory services to the Government of the Republic of Korea in support of the activities of the Asia-Pacific Satellite Communications Council.

177. In 1998 and future years, the ECA secretariat will continue to provide expert services to the ad hoc expert group meeting of the African Technical Advisory Committee on AISI to discuss and synthesize

recommendations regarding: norms and standards for wide connectivity; sharing and dissemination of development information on harmonization of the information structure and infrastructure in the region; and targeting experts on electronic data interchange and connectivity.

178. The ECA secretariat will provide advisory services, on request, to member States on the following: (a) the development of national information and communication infrastructure plans and operation; (b) development of information content and establishment of Web sites; (c) development of national information and communication infrastructure plans appropriate for maximum utilization of modern information technology and its effective operation in the region.

179. Activities of ITU in the area of satellite communications include the following:

(a) At the request of administrations of member States that are developing countries, BDT will continue to provide experts to participate in satellite Earth station projects and in the planning of regional or domestic satellite communication systems. Documents prepared by BDT, such as telecommunication development plans, master plans or sectoral studies, usually include a satellite component;

(b) Administrations of member States will continue to be kept informed on a regular basis, through the weekly circulars of BR and its special sections annexed thereto, and subsequently by fortnightly circulars on CD-ROM, of the basic technical characteristics, frequency assignments and orbital positions of space systems communicated to the Bureau. This information is also made available on the Internet.

Study, pilot projects and operational applications

180. In 1998 and beyond, the Office for Outer Space Affairs, within the framework of the United Nations Programme on Space Applications, will continue its collaboration with several African and European countries on the implementation of the COPINE project, which would establish a satellite-based information exchange network among African professionals, educators, scientists and decision makers at the national, regional and international levels. The preparatory activities include: the consolidation of European participation in the project, particularly in the funding aspect; activation of the COPINE user community; preparation of a detailed implementation plan for COPINE in African countries; establishment of partnerships between European and African companies; and early demonstration of the capabilities of the COPINE system. The Office will cooperate closely with African countries particularly in preparing a detailed plan for the implementation of COPINE in the countries concerned.

181. UNEP will continue, in 1998 and beyond, the development and implementation of Mercure, a satellite-based telecommunications system designed to improve global access to environmental information and inaugurated at Geneva on 5 November 1997. Mercure comprises a configuration of 16 International Telecommunications Satellite Organization (INTELSAT) Earth stations donated by six ESA member States (Austria, Belgium, Norway, Spain, Switzerland and United Kingdom). It uses INTELSAT satellites in geosynchronous orbit over the Indian and Atlantic oceans. The installation and build-up phase of the Mercure project is nearing completion, and the construction of Earth stations at 14 sites was completed by early 1998. High-capacity Earth stations have been established at Arendal, Norway, and at Bangkok, Beijing, Geneva, Nairobi and San José. These stations will serve more information management needs of national and regional environment authorities and UNEP headquarters and regional offices. Lower-capacity stations to meet the information management needs of national environment agencies have been established at Almaty, Kazakhstan, and at Hanoi, Katmandu, La Paz, Manama, Maputo, Niamey and Vienna, and the establishment of another station at Havana is nearing completion.

182. Consistent with the objectives of chapter 40 of Agenda 21, UNEP has also developed UNEPNet, an international environmental Internet that will better meet the information management needs of UNEP partners and users of environmental information worldwide. Mercure is essential to the viability of UNEPNet in developing countries and in countries with economies in transition, providing an exciting application of satellite telecommunications for global delivery of environmental information products. Modern and cost-effective data communications, both within UNEPNet and through links to the global Internet, continue to provide access to comprehensive information on the environment and sustainable development. The technology standards of the Internet, combined with flexible and adaptive access services, provide the broadest basis for information outreach today and include commonly used Internet tools such as electronic mail and World Wide Web services to improve the access to and exchange of environmental information throughout the world. UNEPNet is being developed as the Intranet system infrastructure of the organization with connections to national focal points.

183. UNEP will continue to promote the exchange of data and other information through INFOTERRA, which now has national focal points in 175 countries. INFOTERRA supports a number of clearing-house mechanisms and maintains a subscription list for environmental queries and a Gopher node on the Internet. UNEP continues to promote telecommunications methods, including satellite-based communication and other methods to exchange environmental information for the above-mentioned purposes. INFOTERRA released a new version of its environmental thesaurus, Envoc, which is used as a basis for all UNEP database terminology.

184. In 1998 and 1999, ECA will carry out several field projects with United Nations partners, intergovernmental and non-governmental organizations and member States to implement AISI.

185. ESCAP is currently implementing the study project entitled "Promoting cooperation on space technology applications with special focus on satellite-based education for human development and sustainable development in the Asia-Pacific region", with funding from the Government of France.

186. ESCAP will implement the study project "Integrated rural capacity-building through development and application of satellite-based community teleservice centre (CTC)", with funding from the Government of the Netherlands.

187. ESCAP is currently developing a proposal for a regional project on the applications of the information superhighway infrastructure.

188. UNESCO is continuing to examine different ways and means of making wider use of low- and geostationary-orbit satellite systems for communication, information, informatics, education, science, culture and environmental protection in the implementation of programmes and projects such as the following:

(a) Within the framework of the recovery plan of the Pan-African News Agency, the African Network for Integration and Development (RAPIDE) is being established. RAPIDE is aimed at ensuring the strong presence of Africa on the economic, scientific, social and cultural fronts, on Internet, which will thus be used as catalyst for the economic development of the continent. On the technical front, RAPIDE will use the connecting facilities offered by the International Society of Aeronautical Telecommunications;

(b) Within the framework of the International Commission on Education for the Twenty-first Century (Delors Commission), UNESCO will continue to assess, evaluate and study the experience achieved in distance education, as well as the impact of new communication and information technologies, in particular, communication satellites applicable to distance education.

189. UNESCO is establishing a satellite-based network for distance education in central and eastern European countries to provide cross-border educational and training services, such as the provision of course material,

interactive television and computer and videoconferencing, to students in those countries. A number of educational and research centres in central and eastern Europe, including the UNESCO Institute for Information Technologies in Education in Moscow, will participate in the network, for which extrabudgetary support will be sought for implementation over a period of three years. Using the same techniques, the project could be extended to countries in other regions, such as Africa, Asia or Latin America.

190. Within the framework of the UNESCO initiative "Learning without frontiers", which fosters lifelong education for all at all levels, joint ITU/UNESCO pilot projects on education application of interactive television are being implemented. The project, which supports the teaching of primary teachers in developing countries, consists of providing sound and visual images to the "virtual classrooms". The return path enables the viewer to communicate by voice and data channels with the broadcast site. While UNESCO will be responsible for the conceptual aspects and educational content, ITU, which is developing the standards, will take primary responsibility for the technical implementation and choice of technological solutions.

191. ITU will continue to contribute in this sphere through the following activities:

(a) In the light of technological development, ITU radiocommunication study groups 1, 3, 4, 7, 8, 10 and 11 will pursue studies on technology and spectrum/orbit utilization for space communications. The radiocommunication study groups are part of the ITU Radiocommunication Sector (ITU-R), which is responsible for studying technical, operational and regulatory/procedural questions on radiocommunication, issuing recommendations and preparing the technical basis for radiocommunication assemblies and world radiocommunication conferences;

(b) The Telecommunication Standardization Bureau of ITU has been studying technical, operational and tariff questions and adopting recommendations on them with a view to standardizing telecommunications on a worldwide basis. The priority for the Bureau is the elaboration of standards for the implementation of the Global Information Infrastructure and global multimedia mobility. The Bureau will continue its studies in the application of space technology in different services, such as aeronautical, maritime and land mobile telecommunication services to remote regions and for weather forecasts. The Bureau will also continue to ensure the full integration of the satellite transmission medium in worldwide telecommunications networks;

(c) The intersectoral groups of ITU-R and Telecommunication Standardization Bureau ensure that studies carried out in the two sectors are conducted in a harmonized way, avoiding any possible overlapping and dispersion of efforts. The intersectoral group on International Mobile Telecommunications-2000 (IMT-2000) also considers the satellite-related future aspects of international mobile telecommunication. The intersectoral group on satellite matters reviews the recommendations of the two sectors in order to ensure the full integration of the satellite transmission medium in the telecommunication networks, taking into account emerging technology, applications and services;

(d) BDT is continuing its work to implement the Buenos Aires Action Plan for Global Telecommunication Development, which was adopted by the first World Telecommunication Development Conference (WTDC), held at Buenos Aires in March 1994. The agreed goals and objectives of the Buenos Aires Action Plan, reflected in a concrete four-year work programme, have been actively implemented since 1994 in all five ITU development regions, and their implementation is expected to continue beyond 1998. The implementation of the Buenos Aires Action Plan will make telecommunications a principal factor contributing to sustainable development. The Buenos Aires Action Plan comprises the following three parts: a programme of cooperation among the members of the Telecommunication Development Sector of ITU; a BDT plan of action for assisting developing countries; and a special programme for the least developed countries. The second part of the Buenos Aires Action Plan consists of 12 programmes, including programmes on the following: policies, strategies and financing; human resource management and development; frequency management;

integrated rural development; and broadcasting infrastructure. Satellite communications are an integral part of the programmes. The Buenos Aires Action Plan mainly refers to coordinated regional and global activities. Those activities will be complemented by multilateral and bilateral projects executed or supported by ITU and its development partners;

(e) Within the framework of the Buenos Aires Action Plan for Global Telecommunication Development, which listed as a priority item the need to increase the accessibility of telecommunication services in rural and remote areas in developing countries, ITU launched in 1994 an interregional project for developing countries, SPACECOM. The project was designed by BDT, in association with industry. The project seeks to promote the broad applications of space communications technology in developing countries, which would greatly contribute to the development of the countries concerned and the satellite communication industry by forging a strong partnership between the space communications industry and the telecommunication operator and user community in developing countries. Satellite communication technology may well provide a low-cost means of establishing various types of telecommunication services (telephony, video, data) anywhere in the world, but many obstacles still stand in the way of its application in developing countries.

192. Although the involvement of ITU in the Regional African Satellite Communications System project formally terminated in December 1993, ITU is following its activities and coordinating with the Pan-African Telecommunications Network, since the two systems (satellite and terrestrial) are complementary (A/AC.105/551, paras. 151 and 152). In particular, rural and remote areas will have to be linked to the networks through either of the above systems.

193. ITU will participate in the pilot projects initiated by Tunisia, entitled "Establishment of a terrestrial and space telecommunications infrastructure for an integrated information system on the environment and sustainable development in Tunisia" and "Establishment of a satellite-based network for the remote monitoring of sea-water quality". ITU will also participate in a project undertaken by Benin, entitled "Pilot project for natural disaster warning system".

194. The second WTDC, held at Valletta from 23 March to 1 April 1998, analysed the implementation of the Buenos Aires Action Plan, adopted by WTDC in 1994 and incorporated into the Valletta Action Plan for the period 1999 to 2003. The Valletta Action Plan includes a number of projects, one of them concerning the introduction of new technologies and new services for developing countries. Under the latter project, a number of seminars and workshops will be organized on the following subjects: (i) GMPCS; (ii) technological convergence; (iii) digital audio and video-broadcasting; (iv) spectrum management; and (v) telemedicine, tele-education and other services. The Conference reviewed the execution of the SPACECOM project and updated the programme for its further development. The Conference also adopted a work plan for the development of a long-term strategy for the future use of the frequency spectrum in developing countries.

3. Dissemination or exchange of information on the status of technology or operational systems through meetings or publications

Dissemination of technological information

195. In 1998 and 1999, ECA will prepare and disseminate the following publications:

(a) Training modules for planners and decision makers on the following: (i) the importance of AISI; (ii) developing African information content; and (iii) how to utilize information and information technology to build competitiveness of African economies and society, in 1998;

(b) Case-study report on the best policies for development information and communication infrastructure;

(c) Report on the use of information and communication technologies to stimulate economic growth: case studies on best practices, in 1998;

(d) Two issues of newsletter on development information in electronic and printed formats;

(e) Annual publication on training modules on developing norms and standards for African information content;

(f) Training module on building Web sites, in 1998.

196. During the period 1998-1999, ESCAP will prepare and disseminate the following publications:

(a) Report of the Regional Seminar on Satellite Communications for Distance Education;

(b) Study report on the project "Promoting cooperation in space technology applications with special focus on satellite-based education for human development and sustainable development in the Asia-Pacific region";

(c) Study report on the project "Integrated rural capacity-building through development and application of satellite-based Community Teleservice Centre (CTC)".

197. ITU will continue to contribute in this sphere through the following activities:

(a) BR periodically publishes approved recommendations, either new or revised, on space radiocommunications. Publications of special interest for space radiocommunications concern issues on space applications; fixed-satellite, mobile-satellite, radio determination-satellite, amateur-satellite and broadcasting-satellite (sound and television) services; satellite news-gathering; frequency sharing; and compatibility of different services. They form the basis for harmonious technical development of space radiocommunication systems and contain criteria for the sharing of frequency bands between the various space services, as well as between space and terrestrial systems;

(b) The third edition of the ITU *Handbook on Satellite Communications (Fixed-Satellite Service)* and the *Handbook on the Mobile-Satellite Service* and the *Handbook on Broadcasting Satellite Systems* are under preparation;

(c) BR publishes a quarterly updated list of orbital positions and associated frequency bands of space stations on board geostationary satellites and non-geostationary space systems. In more detailed form, it publishes all the technical characteristics of satellite networks submitted to it under the coordination or notification procedures, for recording in the Master International Frequency Register. The information is also available on Internet;

(d) BDT will issue in 1998 a report of the Group of Experts established by the Director of BDT in accordance with Opinion 5 of the 1996 World Telecommunication Policy Forum (WTPF). This report analyses the list of factors which should be taken into account for introducing GMPCS services;

(e) BDT will publish in 1998, in collaboration with the GMPCS operators and industry, a reference book compiling basic technical, operational, regulatory and socio-economic information related to the introduction

of GMPCS technology and services in the world in general and in the developing countries in particular. This work is part of BDT assistance to the developing countries in apprehending and optimizing the use of and benefits from GMPCS, which is the latest space telecommunication applications technology.

Elaboration of strategies or plans for future applications programmes or systems and/or policy coordination

198. ESCAP will hold the annual meeting of the Regional Working Group on Satellite Communication Applications at Tehran in April 1999. The annual meeting in 1998 was held at Bangkok from 16 to 19 March 1998.

199. ITU will organize WTPF to discuss and exchange views and information on broad telecommunication policy issues, technological advances, infrastructure development and financial business considerations. The second WTPF, which took place from 16 to 18 March 1998 at Geneva, was devoted to policy and regulatory issues raised by an agreement on trade in telecommunication services.

200. ITU organizes on a quadrennial basis the World Telecommunication Exhibition and Forum (TELECOM), at Geneva, as well as similar four-year rotational regional events in the Americas, Asia and Africa. World TELECOM-99 will be the eighth TELECOM and will take place at Geneva from 10 to 17 October 1999. Problems related to the ever-increasing uses of outer space, such as communication satellites, remote sensing and navigational services, as well as direct satellite broadcasting to rural and underdeveloped areas of the world, will be some of the main issues of concern and discussion at these forums.

4. Regulation of the use of the geostationary satellite orbit and the radio-frequency spectrum allocated to space communication services

201. ITU is making preparations for the world radiocommunication conferences (WRCs) in 1999 and 2001. The purpose of these conferences is to update the international radio regulatory process and prepare for future requirements. WRC-99 will continue studying technical and regulatory aspects of communication using geostationary and non-geostationary satellites for various services, such as mobile satellites, Earth-exploration satellites, space research satellites, meteorological satellites and broadcasting satellites. An inter-conference representative group (IRG) will study the feasibility of increasing the minimum channel capacity in the Broadcasting-Satellite Service Plan for countries in regions 1 and 3, to be submitted for consideration by the next WRC.

202. The Conference Preparatory Meeting (CPM), which has been established to carry out the necessary preparatory work for WRC, will continue its work. ITU-R study groups are conducting studies in the field of space radiocommunications concerning technical aspects of mobile-satellite, fixed-satellite, Earth-exploration satellite, meteorological satellite, space research, space operation and broadcasting-satellite services and low-orbit satellite systems. The report to WRC-99 was prepared by the CPM-97 in order to assist the ITU members who will be involved in the deliberations of WRC-99. During the first meeting of CPM-99, the members of the study groups, working parties, task groups, joint rapporteur groups and joint task groups of ITU-R were entrusted with the responsibility of preparing the studies requested by WRC-97 ahead of the forthcoming WRC-99 and WRC-2001. Joint Working Party 10-11S was given the task of studying, in cooperation with IRG, as a matter of urgency, the technical possibilities for increasing the minimum capacity assigned to all countries within regions 1 and 3 by the plans for regions 1 and 3, as contained in appendices 30 and 30A of the plans. The appropriate technical, operational and regulatory studies to review the regulatory provisions concerning the operation of non-geostationary fixed-satellite systems in the frequency bands covered by appendices 30 and 30A will be conducted by a joint task group of ITU-R study groups 4, 9 and 11 of ITU-R.

203. Following the 1994 call by the ITU Plenipotentiary Conference, in its resolution 18, for a new in-depth review of the ITU spectrum/orbit resource allocation, WRC-97 decided to implement a number of aspects in order to increase efficiency and equity in spectrum/orbit utilization. The practical implementation of these measures and its results will be considered by WRC-99.

204. The ITU Plenipotentiary Conference in 1998 will consider the results of the review of the ITU spectrum/orbit resource allocation procedure.

5. Studies on and/or preparations for the establishment of new legal frameworks or the development of new systems to complement the existing legal frameworks

205. One of the decisions of the General Conference of UNESCO, at its twenty-eighth session, was to undertake studies at the regional level on the implications of electronic communication technologies, or "the information superhighways", for the protection and dissemination of intellectual works, in order to contribute to the consideration of the international standards which should govern the protection and circulation of intellectual works by electronic means. Following this decision, three regional committees, for the regions of Latin America, Asia and Europe, held meetings on the above-mentioned subject in order to assess the basic infrastructure of the various segments of the information superhighways, mainly the convergence of telecommunications, broadcasting, including satellite broadcasting, and electronic networks. In particular, the committees will have to define, for each region, the following:

(a) An outline of a national policy for the implementation of the basic infrastructure of transmission and digital dissemination of information, including the role of the State and the private operators, and the rules that must regulate the functioning of this infrastructure and the principles of interregional and international cooperation in this field;

(b) The main principles to follow in adapting national laws in order to ensure the protection of the legitimate rights of authors and of others in the digital multimedia context as well as to promote regional harmonization to secure cultural exchange;

(c) The strategy to be adopted by the States of the region and measures to be taken in order to promote the creation and development of cultural industries that will produce and disseminate products relating to digital works and performances as well as distance education. The Committees are also intended to help States to reach an international consensus for regulating the international circulation of data related to the exploitation of works and performances and to communication in general, within the framework of cyberspace. That will enable UNESCO, pending the decision of the General Conference, to elaborate an international legal instrument or simply set recommendations or guiding principles on the matter.

206. As follow-up to the joint ITU/UNESCO study entitled "The right to communicate at what price?", published in 1995, pilot projects on access to telematics facilities is being implemented in the developing countries by UNESCO, ITU, relevant professional institutions and non-governmental organizations. Two symposia on telematics for development were held in 1997 in Latin America and the Caribbean, as well as in the Arab States. Those activities aim at collaboration between service providers, telecommunications operators and end-users, particularly in sectors of public concern, in order to improve access to telematics facilities. Symposia similar to those held in 1997 are foreseen for the year ahead.

207. ICAO is continuing to consider the legal aspects of the implementation of CNS/ATM systems, which principally relate to the legal framework for the Global Navigation Satellite System (GNSS). The task is entrusted to the Panel of Legal and Technical Experts on the Establishment of a Legal Framework with regard

to GNSS, established by the ICAO Council in December 1995 upon the recommendation of the Legal Committee, as endorsed by the thirty-first session of the ICAO Assembly.

208. The ICAO Panel of Legal and Technical Experts has elaborated a draft Charter on the Rights and Obligations of States Relating to GNSS Services, which embodies fundamental principles applicable to GNSS. It has also put forward 16 recommendations related to certification, liability, administration, financing and cost recovery and future operating structures. The draft Charter and the recommendations, which were considered by the ICAO Council during its one-hundred-fifty-third session, will be submitted to the forthcoming thirty-second session of the ICAO Assembly, to be held from 22 September to 2 October 1998.

6. Land, maritime and aeronautical mobile satellite services

209. Within the framework of ITU-R Study Group 8 and the relevant study groups of the ITU-R and ITU Telecommunication Development Sector, ITU is developing a series of standards for the development of IMT-2000, which is aimed at providing satellite and terrestrial mobile telecommunication services anywhere and at any time.

210. IMO is continuing its studies on a worldwide radio-navigation system and has adopted a revised policy for recognition and acceptance of such systems (IMO resolution A.815(19)). GPS and GLONASS, which had been offered by Governments as operational candidate systems, were evaluated, recognized and accepted in 1996. Amendments to the 1974 International Convention for the Safety of Life at Sea are being developed, taking into account the above-mentioned policy.

211. As the operational availability of GPS has been guaranteed by the United States only until 2005 and the operational availability of GLONASS has been guaranteed by the Russian Federation only until 2010, IMO is considering the need and seeking the means to develop plans for a post-GPS/GLONASS system, on the basis of internationally controlled civil GNSS in cooperation with ICAO and other user organizations. A maritime policy for a future civil and internationally controlled GNSS was adopted in November 1997 (IMO resolution A.860(20)). Furthermore, ICAO is developing provisions for ground and satellite-based augmentation systems for GPS/GLONASS to improve their overall availability, integrity and accuracy for aeronautical applications.

212. ICAO, recognizing the limitations of the present air navigation systems and the need to meet future requirements, has taken steps to promote the introduction of, *inter alia*, satellite-based technologies for communication, navigation and surveillance (CNS) elements in support of global air traffic management (ATM). The systems are an integration of terrestrial and space elements that will fulfil future international civil aviation requirements well into the next century. A fundamental prerequisite for the implementation of the systems on a global basis includes the development of uniform Standards and Recommended Practices (SARPs). Several panels of experts are involved in these activities under the responsibility of the ICAO Air Navigation Commission. With respect to space-related elements of the CNS/ATM systems, SARPs and guidance material have been completed for the aeronautical mobile-satellite service. SARPs for other elements including GNSS are expected to be completed within the 1998-1999 time-frame. SARPs for air traffic service applications including automatic dependent surveillance (ADS) systems and procedures, which are largely supported by satellite communication, are under development. Early ADS provisions will be available in 1998 and are expected to be finalized in 2001. Provisions for the emergency locator transmitter, based on the International Search and Rescue Satellite System (COSPAS-SARSAT) programme are being reviewed, and amended SARPs are expected to be completed in the year 2000.

213. The planning and implementation of the CNS/ATM systems of ICAO are facilitated by a global plan and the activities of regional planning and implementation groups, such as the worldwide CNS/ATM systems implementation conference, held at Rio de Janeiro, Brazil, from 11 to 15 May 1998.

214. ICAO and IMO are continuing cooperation for the multimodal use of GNSS in order to ensure that the service provided by the system will meet the needs of maritime users as well as the aviation community.

C. Meteorology and hydrology

1. Education and training programmes

Training courses, workshops and seminars

215. ESCAP will hold, with support from the Government of China, the Regional Training Workshop on Development of Meteorological Databases and Applications in Disaster Management, at Beijing, China, in 1998.

216. Both IOC and the Coastal Regions and Small Islands Unit of UNESCO will continue to organize regional training courses on the applications of remote sensing data to marine studies using BILKO image-processing software (Windows version), within the framework of the Training and Education in Marine Science programme. Since 1987, five self-tutoring packages of computer-based lessons have been produced with BILKO software, which have been distributed to educational establishment in more than 100 countries.

217. WMO plans to continue to collaborate with the United Nations, other organizations and WMO members in the co-sponsorship of training events during the biennium 1998-1999. The WMO proposals for satellite-related events for the biennium include a training course on tropical cyclones, to be held in Australia in 1998, with emphasis on small island developing States and the southern hemisphere, and the eighth training course on tropical meteorology and tropical cyclone forecasting, to be held in the United States in 1999. Under the WMO Education and Training Programme, the WMO Regional Meteorological Training Centre (RMTC) at Nanjing, China, is planning a one-month International Training Course on Satellite Meteorology, in 1998, and WMO/European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) is planning a Regional Training Course on Satellite Meteorology at Niamey, in 1998. The programme of the postgraduate course in hydrology held annually in Kenya contains training in the use of satellite-based images and GIS in hydrology and water resource assessment. In the projects funded by the World Bank in the Mediterranean Sea Basin, called Mediterranean-Hydrological Cycle Observing System (HYCOS), or MED-HYCOS, staff from 21 countries will continue to be trained in the operation and management of DCPs using Meteosat for collecting hydrological, water-quality and related meteorological data. A similar project, called SADC-HYCOS, will be launched in 1999 for the SADC area.

Fellowships

218. IOC of UNESCO provides annual grants to scientists from developing countries, through the Training, Education and Mutual Assistance Programme, to enable them to participate in short-term training courses in remote sensing on marine-related issues.

219. WMO grants fellowships under its Voluntary Cooperation Programme and its regular budget, as well as through UNDP and trust funds, for studies or training in meteorology, climatology and operational hydrology, including studies and training in satellite meteorology, interpretation of meteorological satellite photographs, satellite transmission systems and nephanalysis. In addition to fellows being trained at the WMO regional meteorological training centres, WMO members also provide training in numerical weather prediction products

and interpretation of meteorological satellite data through fellowships offered by them under the Voluntary Cooperation Programme.

2. Expert services and survey missions to identify specific areas of applications relevant to a given country or group of countries and to carry out specific studies on pilot projects or to implement the projects with operational applications of technology

Provision of expert services and survey missions

220. UNEP, through GRID Arendal, will continue to maintain a coastal environmental information system for the International Northern Sea Route Programme. Key institutions in Japan, Norway and the Russian Federation are linked to the project.

221. UNEP, through GRID Arendal, is continuing to maintain the Baltic Sea catchment area database. The database can be accessed through the Internet and the World Wide Web.

222. FAO continues to assist in developing a Nile forecasting centre within the Ministry of Public Works and Water Resources at Cairo to monitor and forecast the flows of the Nile and its tributaries. The project is supported by USAID and is being carried out with the United States National Weather Service as a subcontractor for the development of hydrological models.

223. Through its Regional Remote Sensing Project in the SADC area, FAO assists SADC, in cooperation with the Department of Meteorological Services of Zimbabwe, in establishing its own facility for reception and processing of Meteosat data, which is expected to become operational in the spring of 1998.

Study, pilot projects and operational applications

224. UNEP will continue to participate in the programmes of the GCOS secretariat as appropriate and necessary. UNEP will continue to cooperate in the implementation of GOOS and, with FAO, UNESCO, WMO and ICSU, in the further development of GTOS. (See paragraphs 105 above and 235 and 237 below.)

225. ESCAP will develop and make accessible a database of various parameters relating to meteorological satellite applications for disaster management in the Asia-Pacific region in 1998.

226. IOC of UNESCO, through the GOOS Living Marine Resources Panel, will foster expertise in using ocean colour data by providing training and capacity-building opportunities, express the voice of the user community, stress the importance of ocean colour data to the global community, optimize the quality of data for validation, especially in coastal waters, advocate the collection of essential ocean and atmosphere data and facilitate merging of access to the data.

227. The application of satellite technology in meteorology, climatology and operational hydrology forms an important element of the technical cooperation activities of WMO. Those activities are generally undertaken with assistance from either the Voluntary Cooperation Programme of WMO or other sources of funding such as UNDP, the World Bank and the European Community. The following activities are planned for 1998 and future years:

(a) *Africa*: A number of WMO members, including France, Germany, Italy, United Kingdom and United States, are donating DCPs to countries in Africa for the collection of meteorological data via the geostationary meteorological satellite Meteosat to improve the availability of observational data at national meteorological centres. Furthermore, eight satellite stations of the International Mobile Satellite Organization

(Inmarsat) were installed in the countries that are members of the Permanent Inter-State Committee on Drought Control in the Sahel with funding from USAID, in order to enhance the flow of data and products between the AGRHYMET regional centre at Niamey and national AGRHYMET centres. Some key stations in the Zambezi river basin will be equipped with DCPs using the Meteosat system for collecting data. A multidonor project is now under preparation to monitor desert locusts in Africa. Under the project, 50 automatic stations will be installed. In the Niger river basin, 64 DCPs using the Argos system have been operational for a number of years, and plans are being made to install more modern equipment. In collaboration with the World Bank, WMO has drawn up plans to set up in Africa an advanced hydrological and environmental monitoring system using Meteosat. More than 100 DCPs will be installed on major rivers, costing between 10 million United States dollars ($) and $20 million over a period of five years. For one such regional project for southern Africa, SADC-HYCOS, funding by the European Community served to start installing 50 DCPs in 1997;

(b) *Americas*: The increasing demand in many developing countries of regions III and IV and the limited availability of experts in the major satellite-operating countries prompted WMO to develop a new training strategy known as "training the trainers". In November 1995, NESDIS scientists travelled to RMTCs in Costa Rica and Barbados to explore the possibility of taking an innovative approach for both training and applied research in satellite data utilization and to show how a RMTC could develop considerable expertise in the utilization of, and training capability with, digital geostationary operational environmental satellite imagery by participating in a "virtual laboratory" with the Cooperative Institute for Research in the Atmosphere and Cooperative Institute for Meteorological Satellite Studies, both of NOAA. In addition to the above, through the ongoing project consisting of regional cooperation activities in support of the research on global change in the Inter-American Institute for Global Climate Change (IAI) countries, WMO provided training related to satellite image analysis and processing, using GIS, GIS-SPRING and Met-View software, to 15 countries of regions III and IV, South and North America. CD-ROM Land Remote Sensing Satellite (LANDSAT) images have been bought for the project to enhance the capabilities of the participating countries to process and analyse such data, using modern techniques already provided for the project in previous training courses and seminars;

(c) *Europe and newly independent States*: A number of newly independent States and other new WMO members have been provided with satellite receiving stations as part of the SWISS/SAT/WMO project. Negotiations are under way with the Swiss Development Corporation to provide 10 additional satellite receiving stations to other WMO members to actively monitor the meteorological conditions. Installation of small satellite Earth stations in meteorological services will be pursued and strengthened, in particular for newly independent States, for the reception of meteorological information distributed, via European Telecommunications Satellite Organization (EUTELSAT) satellites, by RETIM of France and FAX-E of Germany within the framework of regional meteorological telecommunications. MED-HYCOS, a project funded by the World Bank, is currently installing 30 hydrological DCPs in the Mediterranean area;

(d) *Asia and Pacific*: Satellite-based telecommunication systems are playing an increasing role for the distribution of meteorological data and products to national meteorological services. The International Communication Satellite systems operated by the National Weather Service of the United States will be extended to serve countries in the South Pacific. A satellite-based communications system is being operated for distributing meteorological information within Asia, and it is likely to be expanded to other countries in the area of coverage of the Asiasat satellite. Inmarsat-M Earth Stations are also considered for improving communications of meteorological services in countries of the South Pacific. Additional systems are currently being installed in the South Pacific States, through the implementation of a European Union project to upgrade the tropical cyclone warning capabilities, as well as in Oman and the United Arab Emirates.

228. The overall long-term goals of the World Climate Research Programme (WCRP), jointly sponsored by WMO, ICSU and IOC, are to determine to what extent climate can be predicted and the extent of human influence on climate. Progress in this scientific programme depends on the successful continuation or new

development of space-based Earth observing systems. Key elements of WCRP with respect to the use of satellite data are as follows:

(a) The scientific plan for WCRP gives high priority to understanding the effects of cloudiness on the radiation and energy budget. The International Satellite Cloud Climatology Project is producing long-term climatological records of global cloud amount and properties, as well as radiation flux data from the international array of geostationary meteorological satellites and operational polar-orbiting satellites. The project has been extended to the year 2000;

(b) Several major observational programmes are pursued by WCRP: after the completion of the final phase of the World Ocean Circulation Experiment (WOCE) in 1997, the Global Energy and Water Cycle Experiment (GEWEX), the Arctic Climate System Study (ACSYS) and the new project entitled "Climate variability and predictability (CLIVAR)" use all operational meteorological satellites, the altimeters on Topex/Poseidon and ERS-2 and their follow-on sensors, as well as the new series of EOS, to be launched in 1998 and 1999.

229. WMO continues to cooperate closely with UNEP, IOC and ICSU in the development of GOOS and to provide support for GOOS planning and implementation.

230. Climate system monitoring activities within the World Climate Data and Monitoring Programme make use of satellite data for monitoring such parameters as sea level, atmospheric temperature, sea ice, snow cover, solar radiation, aerosol optical depth, albedo and clouds. The WMO World Climate Data Information Referral System (INFOCLIMA) includes information on some available satellite data sets needed for climate monitoring and research. A Climate Change Detection Project has been established under the World Climate Data and Monitoring Programme to advise on the suitability of data, including satellite data, for detecting climate change. The World Climate Applications and Services Programme continues to investigate and promote development of potential uses of satellite data in climate applications, especially within the framework of the Climate Information and Prediction Services (CLIPS) project.

231. WMO continues to provide valuable data and assessments concerning atmospheric status through GAW, which it established in 1989 as a long-term monitoring and research system to detect changes in the greenhouse gases, including ozone, aerosols and other trace substances in the atmosphere that may lead to global climate change. GAW data include surface and vertical observations which provide information required to verify satellite-based measurements of selected atmospheric constituents. In particular, GAW, through its more than 150 total ozone monitoring stations, has furnished critical ground truth data to calibrate ozone observations from space. These satellite observations, in turn, provide vital information used in the preparation of near-real-time ozone bulletins on the state of the ozone layer both during the Antarctic austral spring and the northern hemisphere winter. In addition, using four-dimensional variational assimilation techniques, major global numerical weather forecasting centres are starting to assimilate real-time ozone observations from satellites as well as ground-based measurements in order to improve the analysis of stratospheric winds and ozone radiative effects.

232. The WMO Commission for Atmospheric Sciences continues to rely on the use of satellite data for research, for both climate studies and weather analysis and prediction of all time scales. The WMO programmes on weather prediction and tropical meteorology research continue to study the application of high-resolution quantitative satellite data.

233. Major WMO global data-processing centres operated by WMO members within the framework of the World Weather Watch and equipped with supercomputers and high-end mainframe computing facilities depend on remotely sensed data from meteorological satellites for operational input data, particularly in ocean and land

areas for which data are otherwise sparse. Data acquired by meteorological satellites are used in global atmospheric and ocean models for numerical weather prediction and environmental quality assessment, as well as climate monitoring and medium-range, long-range, seasonal and multi-seasonal weather and climate prediction.

234. Based on the structure of the WMO Hydrology and Water Resources Programme, a number of projects relating to hydrological networks and instrumentation, hydrological forecasting methods and systems and the application of remote sensing techniques to operational hydrology are undertaken on a continuing basis. The programme is revised every four years by the WMO Commission for Hydrology. The results of the projects formulated by the Commission at its tenth session in 1996 will be available in the year 2000.

235. The World Hydrological Cycle Observing System, a worldwide programme launched by WMO in 1993, is expanding. Aimed at strengthening hydrological information systems and further promoting international cooperation to enhance sustainable socio-economic development, the programme is implemented through regional or basin-wide components, HYCOS. MED-HYCOS for the Mediterranean rim and SADC-HYCOS for southern Africa are the first two components, which are being established with the support of the World Bank and the European Union, respectively. Other components would be implemented in 1998 and 1999 for the regions of west and central Africa, eastern Africa, and the Caribbean, and the basins of the Black Sea, the Baltic Sea, the Amazon and the Rio de la Plata, as well as the Andean countries. Among the outputs of these projects, each HYCOS is developing a network of national hydrological observatories which would be coordinated at the global level and would provide information of consistent quality, to be transmitted in real time via geostationary satellites of the World Weather Watch system, where applicable. This system will provide valuable data to resource planners, decision makers, scientists and the general public. Modern information technologies, such as the World Wide Web for MED-HYCOS and CD-ROM, are also being used.

236. WMO continues to make joint efforts with UNEP, IOC and ICSU in implementing various programmes under GCOS, which was established by those organizations to conduct observations that would meet scientific requirements for monitoring the climate and predicting climate changes. The Joint Scientific and Technical Committee and the Joint Planning Office continue to develop the plans and strategy for the implementation of GCOS. The programmes of GCOS are being implemented in accordance with the initial plan developed by the Joint Scientific and Technical Committee, which outlined the scientific priorities for the programme and proposed a strategy for proceeding, including defining the components of an initial operational system.

237. Since a space component is considered a key element of the Initial Operational System, the Global Observing Systems Space Panel (GOSSP) was established to: (a) define the components of the initial operational system, based on the existing systems of various space agencies; (b) outline the scientific and technical requirements for observations of global, atmospheric, oceanic and terrestrial climate variables that may be made with space instrumentation; and (c) review existing and planned space agency missions for compliance with GCOS requirements, including assured continuity of the observations. A reviewed and updated space plan is being prepared. Copies of the initial plan for GCOS are available from the Joint Planning Office of GCOS at Geneva or via the Internet at the GCOS home page (http://www.wmo.ch/web/gcoshome.html). The Joint Scientific and Technical Committee also issued the data and information management plan, which outlines strategies for an international data distribution system currently being implemented.

238. WMO, in cooperation with IOC, maintains and continues to upgrade the internationally coordinated agreements, procedures, protocols and facilities, especially software, for the dissemination of meteorological and oceanographic data and information to ships at sea, and for the collection of data from those ships, using the Inmarsat maritime satellite system, in particular the Inmarsat-C facility. The WMO marine broadcast system, which is globally coordinated under GMDSS, will become fully operational in 1998.

239. With the support from the WMO World Weather Watch, the WMO Commission for Aeronautical Meteorology, in collaboration with ICAO, is actively involved in the development and implementation of the World Area Forecast System (WAFS), which uses satellite-based communication systems to distribute information on aeronautical meteorological forecasts in support of commercial aviation (as part of the ICAO aeronautical fixed service). The United Kingdom London World Area Forecast Centre (WAFC) transmits WAFS products via the Satellite Distribution System to cover Africa, Europe and west Asia, and the United States Washington WAFC transmission using two satellites, that covers the rest of the world.

3. Dissemination or exchange of information on the status of technology or operational systems through meetings or publications

Dissemination of technological information

240. UNEP, through DEIA/GRID Bangkok, continues to work on the following collaborative undertakings:

(a) Coastal and Marine Environmental Management Information System for the South China Sea area, covering Cambodia, southern China and Viet Nam;

(b) Further development of the North West Pacific Action Plan of the UNEP Regional Seas Programme.

241. ESCAP will publish posters and CD-ROMs on non-meteorological applications of meteorological satellite data in 1998.

242. UNESCO will organize, within the framework of the International Hydrological Programme and in collaboration with the International Association of Hydrological Sciences, the conference on "Application of GIS in Hydrology and Water Resources Management", at Vienna in 1998.

243. WMO issues a biennial report on the status of implementation of the World Weather Watch. The report includes a section on the space-based portion of the Global Observing System, consisting of a network of geostationary and polar-orbiting satellites. The next report will be published in mid-1999. The status of satellite technology for application in meteorological observations and telecommunications is considered at each session of the WMO Commission for Basic Systems, which meets on a biennial basis. The next session of the Commission will take place during the second half of 1998.

244. The WMO Commission for Marine Meteorology maintains a high level of interest in the use of satellites for ocean remote sensing and the provision of marine services based on satellite data. A rapporteur reports to the Commission and WMO members on issues relating to requirements for, access to and applications of remotely sensed ocean data. The rapporteur also liaises with the WMO Commission for Basic Systems Working Group on Satellites, GOSSP of the Global Observing Systems (GCOS, GOOS, GTOS) and with IOC. The rapporteur will prepare a report for presentation in 1999.

245. The WMO World Climate Programme publishes on a regular basis information on the Global Climate System within the framework of projects such as the Climate System Monitoring and CLIPS. The information is, to a large extent, based on data received from space-based observation platforms. During 1998, CLIPS, utilizing the space-based subsystems and Global Data Processing System of the World Weather Watch, provided special monthly bulletins regarding the El Niño event of 1997 and 1998.

246. A working group of the WMO Commission for Agricultural Meteorology is currently responsible for reviewing and summarizing the development of techniques and methods to obtain and manage ground-based and remotely sensed agrometeorological and agronomic data in the most timely and efficient manner for

applications to agriculture. Following a WMO-sponsored Meeting on Data Spatial Distribution in Meteorology and Climatology, held at Volterra, Italy, in 1997, roving seminars will be held in 1998 and 1999 on data management in applications to agriculture, including the use of remotely sensed data and models for spatial analysis.

Elaboration of strategies or plans for future applications programmes or systems and/or policy coordination

247. The GCOS secretariat, jointly established by UNEP, WMO, IOC and ICSU, reports frequently on the Joint Scientific and Technical Committee, experts and panel meetings. Revised and updated space observation and terrestrial observation plans, including recommendations and the list of user requirements, are available from the Joint Planning Office secretariat. Newsletters to initiate and foster the exchange of ideas and information are provided by the secretariat on a regular basis and are available, together with all other publications, on the Internet link (http://www.wmo.ch/web/gcos/gcoshome.html).

248. UNEP, FAO, UNESCO, WMO and ICSU cooperate in the Sponsors Group for the Global Observing Systems (GCOS, GOOS and GTOS) with the objective of providing advice and making recommendations to the sponsoring organizations and their governing bodies, the Observing System steering committees, secretariats and expert panels, as well as possibly other groups, including funding bodies and Governments. In this context, those organizations particularly contribute to the activities of GOSSP.

249. ESCAP will hold the annual meeeting of the Regional Working Group on Meteorological Satellite Applications and Natural Hazards Monitoring at Bangkok in 1999. The annual meeting in 1998 was held at Tokyo from 23 to 26 March 1998.

D. Basic space science

250. The Office for Outer Space Affairs, within the framework of the United Nations Programme on Space Applications, will sponsor the participation of scientists from developing countries in the thirty-second Scientific Assembly of the Committee on Space Research, to be held at Nagoya, Japan, from 12 to 19 July 1998.

251. The United Nations Programme on Space Applications is planning to hold the Eighth United Nations/ESA Workshop on Basic Space Science: World Space Observatory, in January 1999.

252. In 1998 and beyond, the Office for Outer Space Affairs, within the framework of the United Nations Programme on Space Applications, will continue its collaboration with ESA in carrying out follow-up activities relating to the series of workshops on basic space science organized during the period 1991-1997.

253. ESCAP will hold the annual meeting of the Regional Working Group on Space Sciences and Technology Applications at Kuala Lumpur in February 1999. The annual meeting in 1998 was held at Bali, Indonesia, from 16 to 19 February 1998.

E. Safety aspects and natural disaster reduction

254. The Office for Outer Space Affairs, within the framework of the United Nations Programme on Space Applications, has submitted a proposal to modify a radio receiver and to establish a satellite-based warning broadcasting service for rural, remote and outer communities of small island developing States for the region of Asia and the Pacific. World Space Inc. is currently evaluating technical feasibility and financial implications of the proposed modification. The Office is also preparing a proposal for an Integrated Coastal Area Management project, addressing the priority needs of small island developing States in the Caribbean, with

emphasis on the protection of coral reefs and coastal environment as well as disaster preparedness. The Caribbean Disaster Emergency Response Agency is a co-partner in this project.

255. The United Nations Programme on Space Applications will organize, in cooperation with the Spanish Mission Control Centre at Maspalomas, Gran Canaria, Spain, with support from ESA, the United Nations/COSPAS-SARSAT Workshop on Space Technology for Emergency Aid, at Maspalomas, Canary Islands, Spain, from 23 to 25 October 1998.

256. The secretariat of IDNDR is sponsoring the international scientific and technical conference on early warning systems for the reduction of natural disasters to be held at Potsdam, Germany, from 7 to 11 September 1998. The conference is organized in association with the GeoForschungsZentrum and the German National Committee for IDNDR, with funding provided by the Foreign Ministry of Germany. The conference forms a key thematic component within the concluding phase of IDNDR. It aims at conducting a critical assessment and discussion of successes, lessons from past experiences, development potential and requirements for the effective use of early warning systems in disaster mitigation. The conference will present "best-practice" programmes for early warning systems and institutional capacities as well as the state-of-the-art science and technology, including space and other remote sensing technologies for early warning systems. The conference will contribute to one of the three primary programme targets of the Decade, namely improved access to and effectiveness of early warning at the international, regional and local levels of responsibility.

257. The secretariat of IDNDR will organize a special session on telecommunications for disaster prevention, on 17 June 1998, within the framework of the Intergovernmental Conference on Emergency Telecommunications (ICET-98), scheduled to be held from 16 to 18 June 1998 at Tampere, Finland. The aim of the session is to promote the broader use of telecommunications in support of disaster reduction activities, including space technology and GIS applications for hazard assessment and risk management practices, and will highlight the need for continued research and technical progress, as well as the necessity to protect public and private telecommunication infrastructures from the impact of natural disasters.

258. UNESCO cooperates with the Council of Europe, within the framework of the Council of Europe Open Partial Agreement on the Prevention of, Protection against and Organization of Relief in Major Natural and Technological Disasters, in carrying out research studies on the use of space technology in disaster management.

259. BDT of ITU has a programme from 1994 to 1999 to elaborate, with the participation of IMO, Inmarsat and ITU member States, master plans for the development of maritime radiocommunication services, including the implementation of GMDSS.

260. The ITU-R Study Group 8 (mobile, radio determination, amateur and related satellite services) continues to examine various aspects of satellite uses in GMDSS, including the characteristics of satellite emergency position-indicating radiobeacon (EPIRB) systems, and studies on technical and operational characteristics of satellite systems participating in GMDSS and GNSS.

261. ITU-R will continue to study those aspects of radiocommunications that are relevant to disaster mitigation and relief operations, such as decentralized means of communications that are appropriate and generally available, including amateur radio facilities and mobile and portable satellite terminals. ITU will work closely with the Emergency Relief Coordinator with a view to further increasing ITU involvement in, and support to disaster communications. A draft convention on the provision of telecommunication services for disaster mitigation and relief operations prepared in cooperation by ITU, the Department of Humanitarian Affairs of the Secretariat, the secretariat of IDNDR and the International Committee of the Red Cross will be submitted to the Tampere Conference. The aim of the convention will be to overcome various limitations and barriers experienced in disaster communications. ITU will report on the outcome of the Tampere Conference to the 1998

Plenipotentiary Conference of ITU, to enable the Plenipotentiary Conference, on the basis of all relevant information, to take any action that it may deem necessary.

262. IMO, in close cooperation with BR and the International Hydrographic Bureau of the International Hydrographic Organization, has finalized a study on the use of electronic chart display and information systems on board ships, including means of updating electronic navigational charts, which will be broadcast through the Inmarsat Enhanced Group Call and SafetyNET systems. Operational performance standards for the Electronic Chart Display and Information System have been approved and are being implemented.

263. The amendments to the 1974 International Convention for the Safety of Life at Sea (SOLAS) that were adopted by the 1988 Conference of Contracting Governments entered into force on 1 February 1992, introducing GMDSS. The system is being introduced in stages and will be fully implemented on 1 February 1999. Satellite communications form a major part of GMDSS, and all SOLAS ships are requested to carry a satellite EPIRB. IMO also continues to prepare the master plan of shore-based facilities for GMDSS and provides technical assistance on this matter to developing countries.

264. The further development of GMDSS to provide for its orderly introduction will be continued by IMO in close cooperation with ITU, WMO, the International Hydrographic Organization, Inmarsat and COSPAS-SARSAT.

265. IAEA considers that the use of nuclear power sources in outer space needs to be examined in the context of increasing risk posed by uncontrolled generation of space debris. IAEA also considers that the issues relating to the entry of a satellite with nuclear power sources on board to Earth, following an accident, and the exposure of astronauts, in outer space, to levels of radiation higher than the one normally found on Earth are a matter of potential health concern, and there is a need to consider safety measures in this regard. IAEA is specifically authorized under the terms of its statute to establish standards of safety for the protection of health and minimization of danger to life, in consultation with organizations within the United Nations system, to provide basic requirements for protection against the risks associated with exposure to ionizing radiation and for the safety of radiation sources which may lead to such exposure.

266. The Convention on Early Notification of a Nuclear Accident, which entered into force on 27 October 1986, applies in the event of any accident involving facilities or activities of a State Party or of persons or legal entities under its jurisdiction or control from which a release of radioactive material occurs or is likely to occur and which has resulted or may result in an international transboundary release that could be of radiological safety significance for another State (article 1 of the Convention). According to the Convention, IAEA shall: forthwith inform States parties, Member States, other States which are or may be physically affected and relevant international intergovernmental organizations of a notification received; and promptly provide any State party, Member State or relevant international organization, upon request, with the information received (article 4 of the Convention). Therefore, in view of the above and on account of its statutory and legal obligations, its experience and well-tested infrastructure, IAEA considers it appropriate that IAEA should be a point of reference within the United Nations system in all activities related to radiation safety, including those relating to outer space activities.

267. At its thirty-fifth session, in 1998, the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space agreed to consider its agenda item on the use of nuclear power sources in outer space in accordance with the four-year work plan contained in the working paper submitted jointly by the Russian Federation, the United Kingdom and the United States (A/AC.105/C.1/L.222), to develop a framework for safety assurance processes and standards for nuclear power sources in outer space. In this regard, the Subcommittee endorsed the recommendation of its Working Group on the Use of Nuclear Power Sources in Outer Space that the Secretariat should invite Member States and international organizations to submit

information on the following topics, to be considered in 2000 and 2001: (a) identification of terrestrial processes and technical standards that may be relevant to nuclear power sources, including factors that distinguish nuclear power sources in outer space from terrestrial nuclear applications; and (b) review of national and international processes, proposals and standards and national working papers relevant to the launch and peaceful uses of nuclear power sources in outer space.

F. Other activities in the field of space science

1. Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space

268. The General Assembly, in its resolution 52/56 of 10 December 1997, agreed that a special session of the Committee on the Peaceful Uses of Outer Space (UNISPACE III), open to all States Members of the United Nations, should be convened at the United Nations Office at Vienna from 19 to 30 July 1999. In the same resolution, the Assembly requested the Committee, its Scientific and Technical Subcommittee and the Office for Outer Space Affairs to continue to fulfil their mandates as the Preparatory Committee, the Advisory Committee and the executive secretariat for UNISPACE III. The Assembly also encouraged the active participation of Member States, organizations within the United Nations system and other intergovernmental and non-governmental organizations with space activities, as well as space-related industries, to contribute actively to meet the objectives of UNISPACE III.

269. At its 1998 session, held from 9 to 20 February, the Advisory Committee made a number of recommendations concerning the preparation of the draft report of UNISPACE III and the organization of the Conference, such as the participation of international organizations and space-related industry. Those recommendations of the Advisory Committee are contained in the report of the Scientific and Technical Subcommittee (A/AC.105/697, annex II, paras. 15-43).

270. The Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space, at its 1998 session, held from 23 to 31 March 1998, also considered its contribution to UNISPACE III. The Subcommittee recommended that the Chairman of the Legal Subcommittee should report to UNISPACE III on the work of the Subcommittee, including its past achievements, current work and future challenges in the development of space law.

271. At its 1998 session, to be held from 3 to 12 June, the Preparatory Committee will consider, paragraph-by-paragraph, the first full draft report of the Conference, including the recommendations and Plan of Action of the Conference, prepared by the Secretariat on the basis of comments received from the Advisory Committee, and will consider the organizational aspects of the Conference, based on the recommendations by the Advisory Committee, such as the organization of workshops and seminars on the substantive agenda items of the Conference, the list of space-related industries and international organizations without observer status with the Committee on the Peaceful Uses of Outer Space to be invited, and the organization of activities to be held within the Technical Forum, such as technical presentations, space-industry round tables, public evening lectures and the space exhibition.

272. As part of the preparatory work for the UNISPACE III Conference, the Office for Outer Space Affairs will organize, with support from ESA, regional conferences and meetings (see paragraph 273 below) and coordinate other regional preparatory activities as necessary. In order to facilitate deliberations at the Conference that may lead to the preparation of a plan of action, the Office for Outer Space Affairs will issue background papers on the following topics by August 1998: (i) solar terrestrial relations and global environment; (ii) disaster prediction, warning and mitigation; (iii) management of Earth resources; (iv) satellite navigation and location systems; (v) space communications and applications; (vi) basic space science and its benefits; (vii) commercial aspects of space exploration including spin-off benefits; (viii) information systems for research and applications;

(ix) small satellite missions; (x) education and training in space science and technology; (xi) economic and societal benefits; and (xii) promotion of international cooperation.

273. Following the regional preparatory conference in Asia and the Pacific, which was held from 18 to 23 May 1998 at Kuala Lumpur, the Office for Outer Space Affairs will hold, within the framework of the United Nations Programme on Space Applications, the following regional preparatory meetings for UNISPACE III:

(a) Regional preparatory meeting in Latin America and the Caribbean, to be held from 12 to 16 October 1998, in Chile;

(b) Regional preparatory meeting in Africa, to be held from 26 to 30 October 1998 in Morocco;

(c) Regional preparatory meeting in eastern Europe, to be held in January 1999 in Romania.

274. ECA plans to contribute to UNISPACE III and will organize, during the Conference, an African regional seminar addressing information and communication technologies in Africa in the context of AISI.

275. ECLAC is undertaking consultations with the Government of Chile concerning the organization of the regional preparatory meeting in Latin America and the Caribbean for UNISPACE III and the provision of procedural and logistic assistance for the meeting.

2. Establishment of centres for space science and technology education

276. In response to General Assembly resolutions 45/72 and 50/27, the United Nations Programme on Space Applications continues to make progress in establishing regional centres for space science and technology education, affiliated to the United Nations, in developing countries. The centres are expected to enhance the academic and professional capabilities and technical infrastructure in space science and technology in each region. The following activities will be conducted in 1998 and beyond:

(a) The Programme will continue to provide technical advisory assistance to the regional Centre for Space Science and Technology Education in Asia and the Pacific, which was inaugurated in India in November 1995, in developing and organizing educational and training programmes in various fields of space applications. The Centre started the fourth nine-month course on satellite meteorology and global climate on 1 March 1998 and will hold a postgraduate course on space science from 1 June to 30 November 1998 and a postgraduate course on remote sensing and GIS from 5 October 1998 to 30 June 1999;

(b) The Programme will provide technical advisory assistance to the Governments of Brazil and Mexico, which announced that they had ratified in 1997 the agreement establishing the regional Centre for Space Science and Technology Education in Latin America and the Caribbean, and will coordinate educational and training activities with the Centre;

(c) The Programme is providing assistance to the Governments of Morocco and Nigeria for the establishment of centres for French-speaking and English-speaking countries in Africa, respectively; those centres are expected to become operational in the second half of 1998;

(d) The Programme will provide assistance, as necessary, to the international initiatives to establish a regional centre in western Asia, which currently involve Jordan, Saudi Arabia and the Syrian Arab Republic;

(e) The Programme continues to provide technical assistance in support of the international initiatives to establish a network of space science and technology education and research institutions for central and south-eastern European countries, which involve Bulgaria, Greece, Hungary, Poland, Romania, Slovakia and Turkey; in this connection, the Programme will undertake a study on the technical requirements, design, operation mechanism and funding of the network.

277. ESCAP, with support from the sharing of experience in space fellowship programme (SHARES) of the Government of India, will provide two long-term fellowships in 1998 for training on meteorological satellite applications at the Centre for Space Science and Technology Education in Asia and the Pacific, at Ahmedabad, India.

3. Other activities

278. The United Nations Programme on Space Applications is planning the following activities in the period 1998-1999:

(a) United Nations/European Space Agency Symposium on Economic Benefits of Applying Space Systems for Resource Planning, Education and Communication Infrastructure, which is being organized with the Government of Austria, the province of Styria, the city of Graz and ESA from 7 to 10 September 1998;

(b) United Nations/International Astronautical Federation Workshop on Expanding the User Community for Space Technology in Developing Countries, being co-sponsored by ESA and the European Commission and organized in cooperation with the Government of Australia, to be held at Melbourne, Australia, from 24 to 27 September 1998;

(c) Third United Nations International Conference on Spin-Off Benefits of Space Technology: Challenges and Opportunities, to be held in Asia in 1999;

(d) United Nations/Austria Symposium on the Use of Space Technology for Development, to be held at Graz, Austria, in 1999;

(e) United Nations/International Astronautical Federation Workshop on Information in Support of Sustainable Development, to be held in the Netherlands;

(f) United Nations Second Seminar on Space Future and Human Security, to be held in the province of Tyrol, Austria, in 1999.

279. The Office for Outer Space Affairs, in the period 1998-1999, will continue to provide technical advisory assistance to the Government of Uruguay in its follow-up, as *pro tempore* secretariat, of the recommendations of the Third Space Conference of the Americas, held at Punta del Este, Uruguay, in November 1996, in particular the implementation of the plan of action adopted at the Conference.

280. Since 1989, the United Nations Programme on Space Applications has published an annual collection of papers selected from among those presented at the meetings, workshops and training courses organized under its auspices. The publication, entitled *Seminars of the United Nations Programme on Space Applications*, covers different aspects of space science and technology. It includes papers that are broad in scope and of enduring interest. The ninth edition, which contains manuscripts presented at meetings organized in 1997, has already been issued, and the tenth edition will be issued in early 1999.

281. In order to keep the Member States and the general public informed of the latest developments in activities carried out by the United Nations Programme on Space Applications, the home page of the Programme was established on Internet within the home page of the Office for Outer Space Affairs. The home page, which is accessible through the World Wide Web (http://www.un.or.at/oosa_kiosk/sapidx.html), contains information on activities that have been implemented, as well as reports and press releases issued within the framework of the Programme. The schedules, objectives and programmes of planned activities are also included in the home page.

282. UNEP continues to maintain the International Cleaner Production Information Clearing House as a source of environmental information and the Clearing House for Information on the Global Programme of Action relating to Land Based Sources of Marine Pollution.

283. ESCAP will continue to publish the quarterly *Space Technology Applications Newsletter* in 1998 and 1999.

284. ESCAP will also prepare, publish and disseminate the following special publications as part of its regular information services:

(a) Proceedings of seminars, symposia, workshops and meetings organized by ESCAP in 1998 and 1999;

(b) Study on the harmonization of various initiatives for promoting regional cooperation in space technology applications for sustainable development in Asia and the Pacific, in 1998;

(c) *Space Technology Application Capabilities, Facilities and Activities in the ESCAP Region: A Regional Inventory*, in 1998;

(d) *Space Technology and Applications for Sustainable Development in Asia and the Pacific: A Compendium* (second edition), in 1999.

285. Following the fourth meeting of the Inter-agency Subcommittee on Space Applications for Sustainable Development in Asia and the Pacific, held at Manila on 21 May 1998, and the fourth session of the Intergovernmental Consultative Committee on the Regional Space Applications Programme for Sustainable Development in Asia and the Pacific, also held at Manila, from 22 to 23 May 1998, ESCAP plans to hold the following meetings and conference:

(a) Meeting of the regional dialogue forum, set up to continue the process of harmonization of various initiatives for promoting regional cooperation in space technology applications in Asia and the Pacific, with a view to developing a concept for the establishment of a regional space agency, at Ulaanbaatar, from 24 to 25 June 1998, to be held together with the meeting of the Asia-Pacific Regional Space Agency Forum;

(b) Ad hoc High-level Expert Group Meeting for the Preparation of the Second Ministerial Conference on Space Applications for Development in Asia and the Pacific, in 1998;

(c) Second Ministerial Conference on Space Applications for Development in Asia and the Pacific, in December 1999.

286. The Technology Section of ESCWA is conducting a major study aimed at the formulation of science and technology policies for the twenty-first century in the States members of ESCWA. Consideration will be given to addressing issues pertaining to space technologies in the formulation of those policies.

287. In addition to its various publications and information brochures, FAO increasingly uses its Internet Web site (www.fao.org) for dissemination of information on a wide variety of its activities under various programmes

and projects. New communications techniques and Internet technologies are also being used in its distance learning and extension programmes.

288. In 1998, UNIDO will organize, within the framework of its International Centre for Science and High Technology, the following seminars and training courses which mainly focus on the combined application of the decision support system (DSS) and expert systems with GIS and remote sensing:

(a) Introductory course, "The role of GIS, remote sensing and DSS for industrial development", to be held at Trieste, Italy;

(b) Training course, "GIS, remote sensing and DSS application for planning industrial areas in Central and South America", organized in cooperation with the Centro de Levantamientos Aerospaciales y Aplicaciones SIG para el Desarrollo Sostenible de los Recursos Naturales, to be held at Cochabamba, Bolivia;

(c) Training workshop, "Planning industrial siting in African urban areas", to be held in Kenya or Sudan;

(d) Training course, "Waste disposal management, risk assessment and planning using GIS, remote sensing and DSS techniques", organized in cooperation with the Remote Sensing Centre, to be held at Beijing;

(e) Training course, "Urban and industrial development: analysis of environmental transformation with GIS and remote sensing", organized in cooperation with the Ministère de l'Environnement et de l'Aménagement du Territoire, Section Environnement Industriel, to be held at Ariana, Tunisia;

(f) Training course, "Operationalization of GIS and remote sensing for environmental quality monitoring and assessment in coastal industrialized areas", organized in cooperation with the Indian Institute of Remote Sensing and TERI, to be held at Dehradun, India.

289. In addition, UNIDO will administer a fellowship programme to facilitate technological and scientific exchange in areas relating to remote sensing and GIS and will propose and develop national or regional projects in cooperation with local counterparts.

290. The International Bureau of WIPO conducted a study in 1997, with the assistance of consultants from NASDA of Japan, NASA of the United States and ESA, on the desirability and feasibility of adopting rules and/or recommending principles common to all countries and interested intergovernmental organizations for the intellectual property protection of inventions which were made or used in outer space. This study led to the conclusion that there was no need for special legislative provisions at this time concerning the protection of inventions made or used in outer space, but that it was desirable that the International Bureau give information on the existing protection of such inventions to interested States and organizations.

291. The Office for Outer Space Affairs will continue to maintain, on behalf of the Secretary-General, the United Nations public register of information furnished in accordance with article IV of the Convention on Registration of Objects Launched into Outer Space (General Assembly resolution 3235 (XXIX), annex) and to disseminate such information to Member States.

Notes

[1] *Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992* (United Nations publication, Sales No. E.93.I.8 and corrigenda), vol. I: *Resolutions Adopted by the Conference*, resolution 1, annex II.